AIR | ENGINEERING

JANUARY, 1961

MAKING AIR COMFORTABLE, HEALTHY, SAFE, USEFUL FOR PEOPLE, PRODUCTS, PROCESSES

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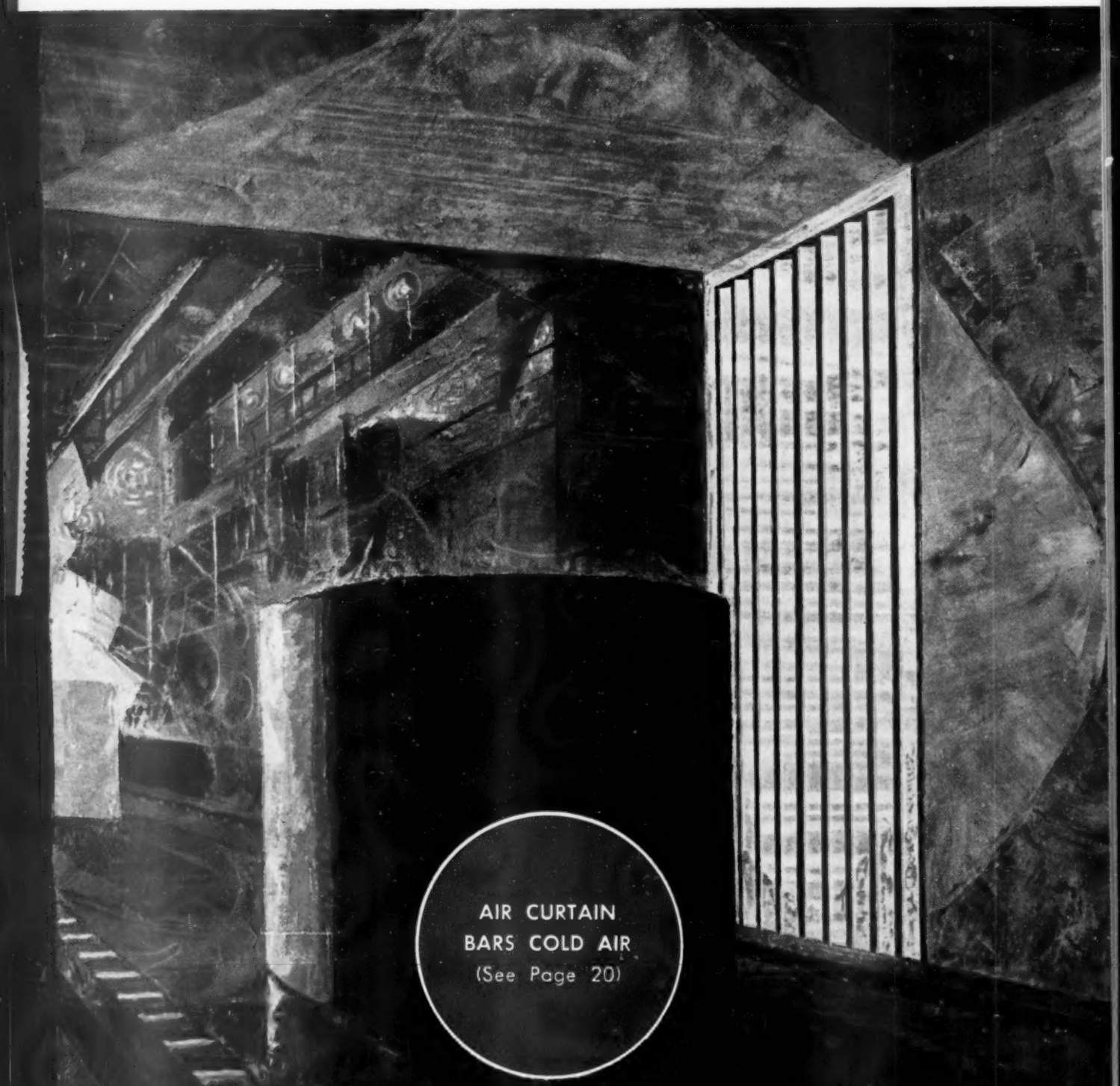
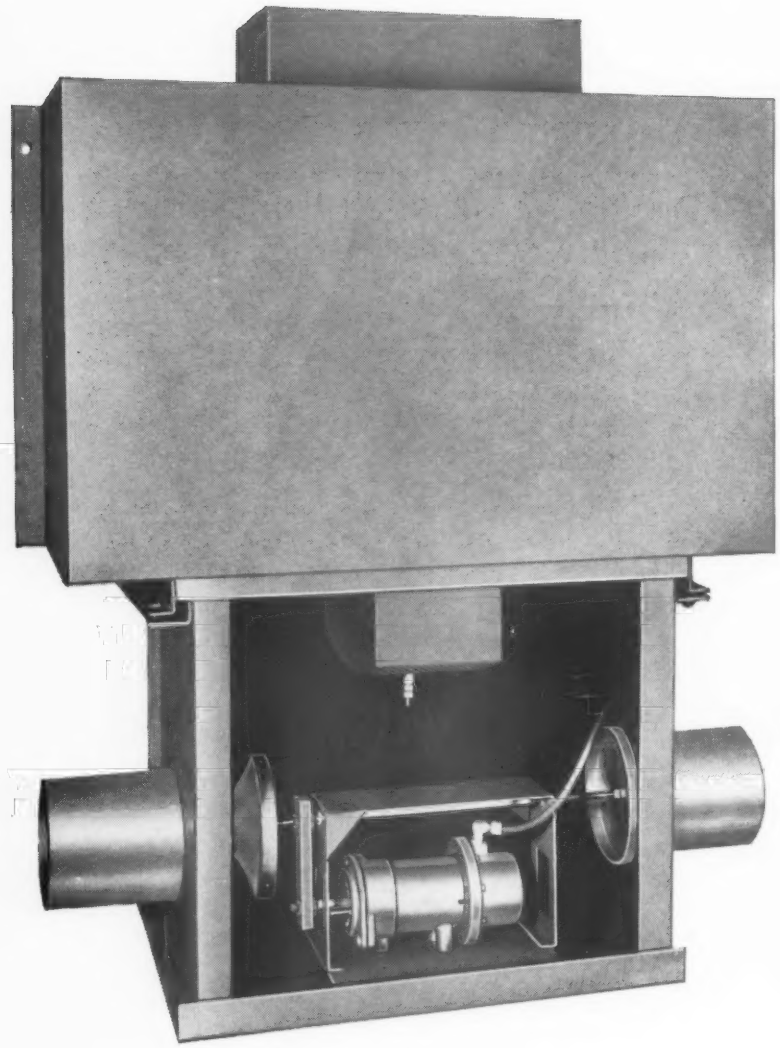
- *How To Air Condition Crane Cabs*
- *Ventilation Design For Plate And Frame Filters*
- *Space and Power Requirements For Precipitators*
- *Automatic Particle Counting Techniques*



AIR CURTAIN BARS COLD AIR
(See Page 20)

ALL NEW AGITAIR® MIXING BOXES



A MAJOR DEVELOPMENT IN CONSTANT CONTROL AND DISTRIBUTION OF HIGH VELOCITY TEMPERED AIR

A simple design of the all new AGITAIR Type "O" series, high velocity mixing boxes eliminates all troublesome linkages and pivots. Only one motor is employed to operate the inlet valves which are driven directly, guaranteeing instantaneous response with no lost motion or backlash.

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Technical catalog HV-100 contains complete performance data and dimensions on all AGITAIR units. Write for your copy today.

FEATURES

1. One motor — no linkages.
2. Aluminum inlet valves driven directly — instantaneous response . . . no lost motion . . . no backlash.
3. Unique AGITROL valve (constant volume regulator) actuated solely by the supply air.
4. Both mixing and attenuation chambers fabricated of galvanized or galvannealed steel . . . sealed to prevent air leakage.
5. Split fabrication of attenuation chamber permits dimension adaptation to meet most space limitations.

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AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

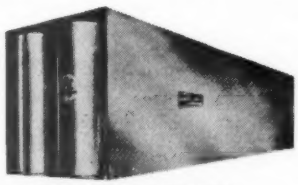
Fan Noise CONTROLLED in Air Handling Systems QUICKLY & ACCURATELY in less than 5 minutes!

Recognition that noise generated by fans in air handling systems could be predicted and controlled has led to a series of developments in both the "calculations" and also the necessary noise control equipment.

Guesstimating has now been eliminated by the general acceptance of these 4 important steps, functions and/or considerations: (1) that the total fan noise and its spectrum is substantially per the ASHRAE GUIDE dated 1957 or later (2) that we now have workable data covering the natural noise reduction due to ductwork, elbows, splits, distances, end reflections, room absorptions, etc. (3) that we have NC and NCA criteria for each of the 8 octave bands for most types of areas and we can now specify what is desired, and more important, by using an octave band analyzer, it can be readily determined whether the specified criteria has or has not been met (4) the development of prefabricated noise reduction units (noise traps, sound traps, etc) which have been properly factory tested and rated so they can be used with the method mentioned above.

"Short Form" Makes Selection Easy

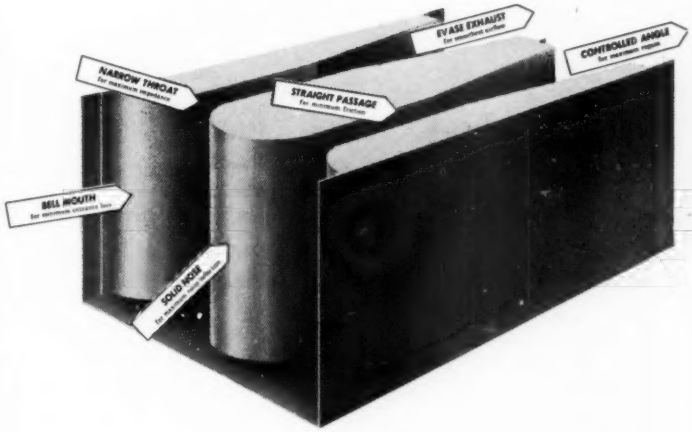
Since that time, because of the progress made in the design of Quiet-DUCT Silencers, and the wide acceptance of newly developed techniques mentioned above, the "Short Form" has been developed to make the selection of unit silencers for air handling systems an easy matter.



QUIET-DUCT SILENCERS
4 STANDARD MODELS
4 LOW PRESSURE MODELS
44 UNIT SIZES
90 MULTIPLE UNIT SIZES

CONIC-FLOW SILENCERS
18 STANDARD UNIT SIZES

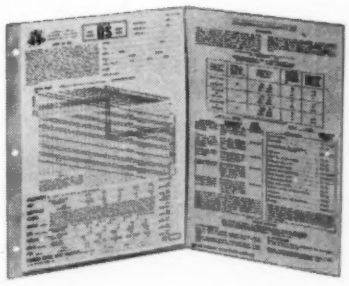
"Cut-Away" View Reveals New Design of "Packaged" Quiet-DUCT Silencers.



Over ten years of experience in controlling noise in air handling systems has resulted in this new, basic design for all "packaged" silencers manufactured by our company. Design requirements include: *Bell Mouth Entrance* for minimum air pressure loss; *Solid Nose* for maximum noise reflection; *Narrow Throat* for maximum noise impedance. *Straight Passages* provide smoother airflow with more silencing and less regenerated noise. *Less Pressure Drop* is achieved by the diverging design of the evasè exhaust, keeping turbulence at a minimum and attaining maximum pressure regain.

The "SHORT FORM" consists of a small binder containing a pad of 25 reproducible work sheets. Only one such sheet is necessary to quickly and accurately resolve each noise problem and determine whether silencers are required, and if so, the silencer model needed to provide the Noise Reduction required for the problem. The "SHORT FORM" gives the Noise Reduction required in the 3rd octave band (in decibels) based on the data and procedures published in the ASHRAE GUIDE & DATA BOOK. Many field experiences have demonstrated that 3rd band calculations, by themselves, are a reliable index to silencing requirements as related to air handling systems. Because of the inherent characteristics of the "packaged" Quiet-DUCT silencers — if silencing is required in the 3rd Band, and the unit silencer is selected based on this criteria, more than enough noise reduction will be provided for all other bands as well.

The "SHORT FORM" is available through our representatives or write direct.



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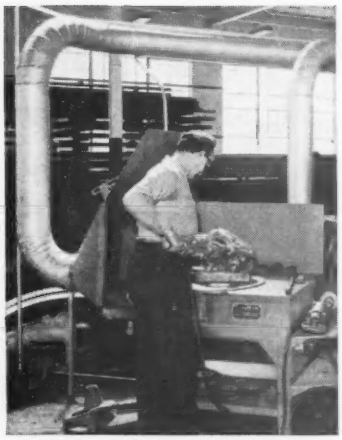
AIR IN MOTION KEEPS MEN IN MOTION

Dusty or fume-laden air can curtail production and increase maintenance costs by dulling worker efficiency and damaging bearings, motors . . . even machines.

Efficient K & B Dust Control Systems put AIR in Motion to become an important production tool.

In the plant of a noted chain and forging firm, an official made this comment about a new K & B installation: "Our workmen can now work full time . . . this means added production for them and for the company as well."

Call on K & B engineers to put *AIR in Motion* and help boost your plant efficiency. The Kirk & Blum Manufacturing Company, 3130 Forrer Street, Cincinnati 9, Ohio



K & B system serving castings grinding removes dust, sand and chips as fast as they are produced. Work revolves on turntable to enable operator to work continuously.

50 YEARS OF SERVICE

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DUST CONTROL

K & B Down Draft Dust Control System in plant of The Monarch Machine Tool Co., Sidney, Ohio

Letters

Two Coils Better Than One?

Editor:

Mr. Omar T. Jacobson questions Mr. L. A. Burch's statement on page 28 (August, 1960 issue), that two coils are better than one etc. etc. Mr. Jacobson claims a coil selected to heat air from -10° to +35° will also heat air from +35° to +80°.

He suggests that Mr. Burch select a steam coil for -10° to +35° and then, using the same coil, check the catalog for coil capacity at +35° entering air temperature. After doing this perhaps he would revise his statement about the coil delivering +80° air with 35° entering air.

Mr. Burch Replies

Editor:

We acknowledge the error in the statement to the effect that the temperature rise of a given coil, would be equal at -10° entering air and at 35° entering air. The exact final temperature under a 35° entering air condition could not be accurately stated unless the steam pressure used was also stated. Even with a high steam pressure in mind the word "approximately" should no doubt have been used in the sentence referred to.

Overheating

The point that overheating can often take place with this method of control of the preheat coil is however, still valid even though we were to use low pressure steam that would result in a 70° to 74° final temperature from a coil which we might have been able to accurately select for the exact temperature rise of -10° to 35°. Ability to use the make up air for cooling has been lost under such a condition and with any process heat gain within the space, overheating would be the result.

We have also observed that overheating trouble from this type of control of the preheat col has often been increased by the coil having been furnished with a greater heating capacity than specified or required. This is often a result of different manufacturers' coils having a different temperature rise and

(Please turn to page 6)

AIR ENGINEERING

VOL. 3, NO. 1

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FEATURES

Air Curtain Stops Cold Blasts At G-E Plant 20
by R. K. Bjorkman, process engineer, General Electric Company, Lynn, Mass. Article gives complete design data and operational experience on air curtain on frequently opened door from outside, which leads into a manufacturing bay.

Space And Power Requirements For Precipitators 23
by R. A. Denbroeder, manager of engineering, industrial gas cleaning department, Koppers Co., Inc.

Ventilation For The Chemical Process Industry 31
by William V. Andresen, chief industrial hygienist, American Cyanamid Co. Article discusses ventilation of plate and frame filter press operations.

How To Use A Mobile Air Sampling Station 34
Report on Orange County, Calif. use of truck-mounted air pollution control lab for checking air pollutants. Contains description of lab and instruments.

Automatic Techniques For Airborne Particle Counting, Part II 37
by A. Lieberman and J. Stockham, Research Engineers, Armour Research Foundation. Second of a two-part series takes up affect of operations and activities on particle content in White Room at Sperry Farragut plant, Bristol, Tenn.

How To Air Condition Crane Cabs 40
by F. W. Wendelburg, chief engineer, electrical division, Harnischfeger Corp. Describes how to install comfort conditioning in crane cabs, where cranes are used over hot work.

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COVER

Cover shows an air curtain in a steel plant. See story on air curtain at a G-E plant on p. 20. Cover plates courtesy American Air Curtain Corp., St. Louis.

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Impasse On Clean Air From Open Hearth Oxygen Conversions?

In Youngstown, Ohio, the Youngstown Sheet & Tube Co. wants to install roof lance oxygen conversion systems on existing open hearths to cut steel production costs to meet completion. City fathers want steel firm to install control devices, such as precipitators, when conversion system goes in. Says steel company president, A. S. Glossbrenner: *"Does the city want the new and more competitive oxygen process . . . or would it rather take its chances on the area falling further behind in jobs and prosperity?"*

The Issue: Older open hearths can be converted to oxygen, but there's so little room for precipitators or other air pollution control devices that adding them may cancel out any benefits from the oxygen conversion. Yet conversions like these up pollution from conventional open hearths about six times.

Complications: Labor union claims even conversion oxygen system will cut jobs, and if pollution increases more than before, its blight will discourage new industry from moving in to take up employment slack.

Needed: An unbiased engineering study to bring an understanding of problems shared mutually by steel company and city.

Around-The-Clock Air Watch Urged

The air pollution surveillance of many cities ends at five o'clock, leaving violators such as junk auto burners a free hand at night. In Chicago, a city alderman, John J. Hoellen, has suggested the city air pollution department be given old police squad cars to use for around-the-clock patrol of the city for night time violators of Chicago's tough new air pollution ordinance.

Industrial Air Conditioning Said To Be Growing Market

A growing awareness among plant managers of the benefits of factory air conditioning and increased interest among educators in air conditioned schools are expected to stimulate sales of large-capacity water chillers above 100-tons, according to Russell Gray, president of Carrier Air Conditioning Company. He forecast the sale of big refrigeration equipment to elementary and secondary schools would amount to $20,000,000 by 1965.

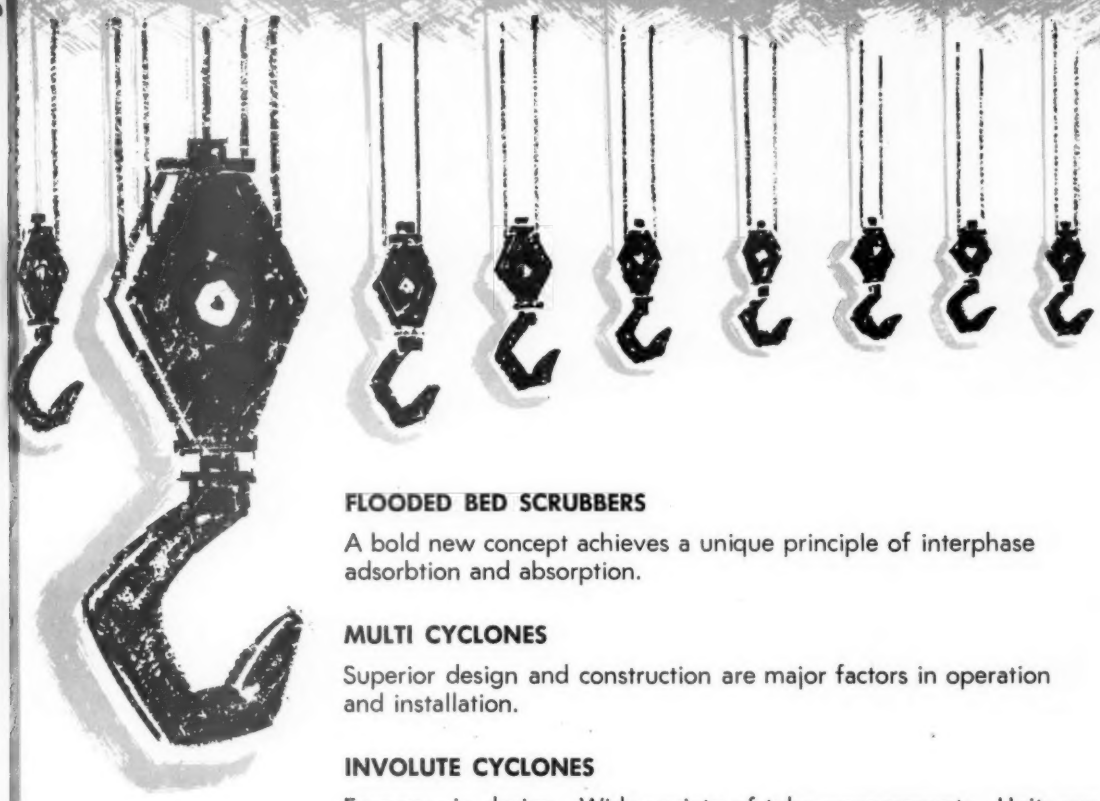
Architects To Learn Advances In Science Of Air Engineering

Material for an all-day seminar on air conditioning is being prepared by the Producers' Council, Inc. The seminar will be presented in record-strip film form and made available to all chapters of the Council. Seminar is in three parts: 1. Architect-client interests in fundamentals of air conditioning and selection of equipment; 2. Design criteria; 3. Human comfort, including temperature and humidity control, air distribution, air cleaning and sound control.

White Rooms At Plant Engineering Show

White Rooms will be the topic of three papers to be presented at the Plant Engineering Conference in Chicago, Jan. 23 through Jan. 26 at the International Amphitheatre. Topics include "Insuring Cleanliness In The White Room," "Pros and Cons of Outside Contracting" and "Keeping Contamination Out Of Air And Water."

Specific Engineering Applications For Industry



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A bold new concept achieves a unique principle of interphase adsorbtion and absorption.

MULTI CYCLONES

Superior design and construction are major factors in operation and installation.

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Economy in design. Wide variety of tube arrangements. Units can be adapted for compact installation.

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FABRIC FILTERS

Extremely high efficiency. Assures clean air inside as well as outside plant. Maximum by-product recovery.

COMBINATION UNITS

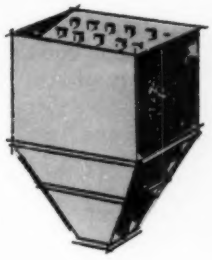
Complete engineering. When special problems arise our engineers design highly successful installations to handle the situation.

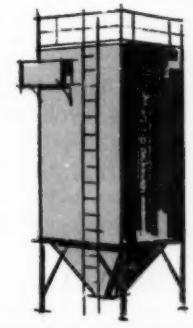
AND MORE . . .

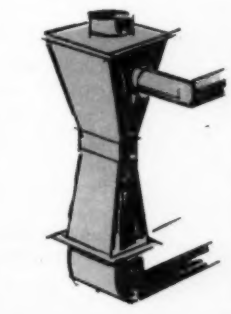
The Air Pollution Control Division of John Wood Company is equipped to help industry control air pollution through engineering service and programing which can be directed to your individual requirements.

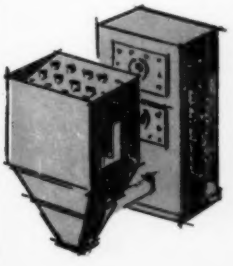
Creative thinking and sound engineering is a John Wood plus that is included in every installation that carries the John Wood Company mark.

Write for the JOHN WOOD COMPANY preliminary kit that helps you help us to solve your problems in air pollution control.









QUALITY PRODUCTS JOHN WOOD SINCE 1867

JOHN WOOD COMPANY

AIR POLLUTION CONTROL DIVISION

Nicolet Avenue · TUcker 7-3201 · Florham Park, N. J.

1961

Letters

(Continued from page 2)

selection being made on the "safe" side.

Another job that resulted in overheating from this type of control had been designed for a particular pressure but process operating conditions required the raising of the steam pressure. This resulted in a higher controlled discharge temperature than was planned.

L. A. Burch
Vice President
V. L. Deppmann Co.

Do Filters Contaminate?

Editor:

Upon removing super-interception type filters from service for replacement with new filters, I noticed that the filtered material, when torn, has filament-like fibers coming out from the filter material. I wonder if the filter itself, because of its construction, would contribute fiber particles to the air stream, down stream of the filters?

M. R. P.
Ohio

Reply to M.R.P.

The media used in super-interception type filters is a paper, resembling in many respects a blotter. The particular paper used in Cambridge ABSOLUTE® filters consists of very fine glass and asbestos fibers, most of them of very short length. A binder is added to give required tensile strength to the paper. This binder also serves to attach firmly any longer fibers which may not be laid down during the paper-making operation.

It is our practice after a filter has been assembled to vacuum clean it thoroughly to remove any dust which it may have picked up (usually on its surface) while being assembled. Filters are tested after vacuum cleaning. If we know filters are going to be used in a white room, we seal them in polyethylene bags so that they will not take up any dust in transit and storage. Filters for such an application should not be installed until the system is ready to be put into operation.

We are not familiar with any instance where filter media with binder has ever shed any fibers, even though these are present and apparent when the filter paper is torn. In one or two cases, where filters have been exposed to relatively high humidities and Kraft paper separators were used, these separators were suspect of giving off "whiskers" after more than a year's operation. For this reason, aluminum separators are most frequently used, although there are one or two cases where even concern about oxidation of aluminum has led to the selection of plastic material as separators.

From a practical point of view, the design engineers specifying a super-interception type filter, using a medium having some binder in it, and constructed in such a way that it can be adequately cleaned after manufacture, can confidently expect that there will be no contribution of fibers from the filter. This is especially true if he specifies aluminum (or if necessary plastic) separators and requires that immediately after testing, filters be sealed in polyethylene bags before packing for shipment.

Robert H. Avery
Cambridge Filter Corp.
Syracuse, New York

Bureau of Criminal Apprehension Wants Dust Data

Editor:

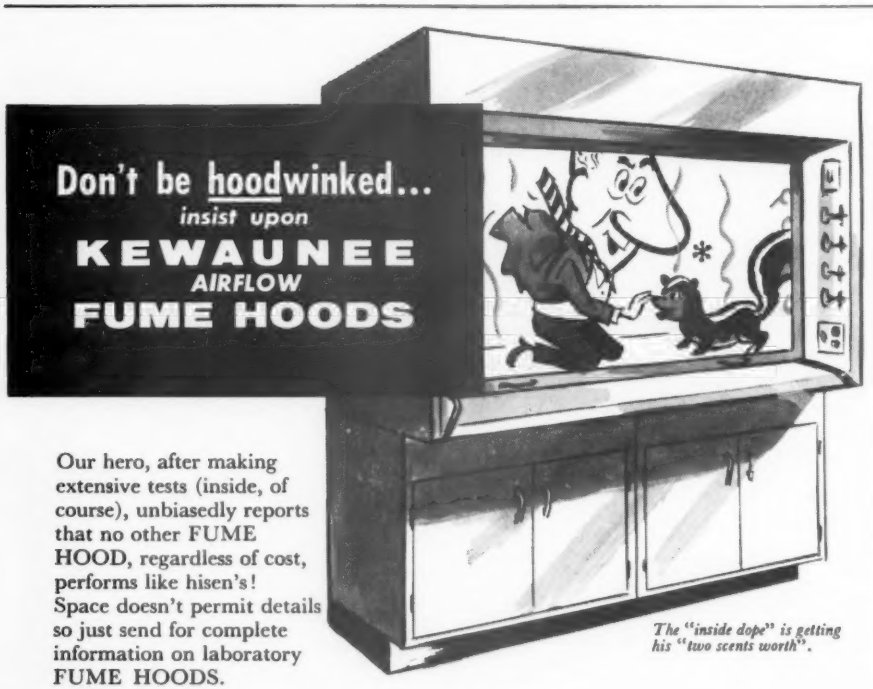
In a recent issue of Chemical Abstracts we came across an article which is of interest to us.

This article, "How Dust Particles are Identified," appeared in AIR ENGINEERING, volume 2, number 1, pages 31-4, 1960. We would like to obtain the address of M. A. Salzenstein so we may correspond with him relative to his article.

Thank you for your consideration.

George W. Roche
Laboratory Director
Bureau of Criminal Apprehension
St. Paul, Minnesota

Use Communications Center, page 35, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.



The "inside dope" is getting his "two scents worth".

Our hero, after making extensive tests (inside, of course), unbiasedly reports that no other FUME HOOD, regardless of cost, performs like hisen's! Space doesn't permit details so just send for complete information on laboratory FUME HOODS.

Note: We have 4 ft., 5 ft., and 6 ft. stainless steel lined Airflow Fume Hoods in stock. They are available for immediate shipment.

* *If you have a group who'd like to see the real "inside dope" on fume hoods, there's a 20 minute movie available.*

K·S·E KEWAUNEE SCIENTIFIC EQUIPMENT ADRIAN, MICHIGAN

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AIR | ENGINEERING

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EDITORIAL:

The Importance Of Make-Up Air . . .

WHY DO SO MANY FACTORIES operate under severe negative air conditions, when the harmful results of these conditions can be observed so easily?

It does not require a specialist in ventilation to suspect something is wrong when fume hoods permit acid plating fumes to spill out over the floor . . . when inside temperature jumps up and down like a yo-yo . . . when employees complain about cold drafts and airborne dirt . . . when grinding wheel exhausts don't exhaust.

Yet these evils, and many more, are today commonplace in many a so-called well ventilated and heated factory. The plant engineer seems unable to persuade management to o.k. purchase of make-up air equipment that will correct these conditions.

What can be done?

Since it costs no more, and sometimes a good deal less, to operate under conditions of balanced air intake and exhaust, the case for make-up air equipment should be easy to prove.

Let's take the case of company XYZ. When the factory was first built its designers had plant air nicely balanced. A little more air was supplied than was exhausted from hoods, booths, etc. Within the year, two more plating tanks and a large paint spray booth had been installed, which together exhausted about 30,000 cfm. Since nothing was done to compensate for the additional 30,000 cfm of air exhausted, the plant now operated under negative air pressure.

A few months later a few more units requiring exhaust were installed, and the plant was then short some 45,000 cfm. In fact, it was literally "starved for air."

What we are now about to relate about plant XYZ will be what we suggest you write down and then show your plant manager in person, adapting these facts to your own picture.

Because more air is being removed *from* than is supplied *to* the plant, outside doors are hard to open, and once open must be shut against a blast of cold air. Try having your boss open and close an outside plant door a few times and tell him why it's so hard to open.

(Please turn to following page)

Editorial (Cont.)

(Continued from preceding page)

When shipping room doors are open, nearby manufacturing areas are subject to blasts of frigid outside air which chills employees and machinery, affecting production from both.

Run your hand along window sills, feel the thin, icy layer of air forcing its way into the plant, spilling over onto personnel as far away as ten feet from outside walls. Walk around the plant with a mercury thermometer, notice how air in inside bays is 10 to 15 degrees warmer than air near cold outside walls.

Point out to your plant manager that cold air leaking into the factory must be heated somehow, and it costs no more to heat it properly, with a make-up air unit, than it does to have it heated improperly by stealing comfort heat away from exterior zones of the plant.

Closely observe plating tank hoods, fume hoods from other processes, and note that these hoods aren't doing their job and that the plating department air is heavy with harmful fumes. Use a smoke gun, or piece of smoking rolled up newspaper to show that the hood isn't "capturing" what it's supposed to exhaust.

Take a look at housekeeping, particularly when dust on products can cause rejects. Dirt-laden outside air, infiltrating into the plant through every nook, cranny and open door, can bring in a whale of a lot of dust and dirt if your plant is in a heavily industrialized area.

These few samples of negative air conditions may vary from plant to plant, and you can make up your own, peculiar to your operation.

Main point to stress in selling your management on the dollars and cents of make-up air, is on production loss due to employee discomfort, product reject due to dirt or poor ventilation, and employee health hazard due to insufficient exhaust of toxic or hazardous dusts, mists or fumes, poor heating, flame failure in heating plants.

Check your natural draft heating equipment with a CO indicator. Chances are you'll find carbon monoxide being pulled back into the plant through flues. And remember to add up the heat you waste trying to heat hard-to-heat outside wall areas. The thermostat, located in central plant areas, must be set high to get heat to outside areas, so the inside zones are overheated without doing a good job in exterior zones.

It's impossible to be specific about the dollars and cents of make-up air in a general discussion of the subject. The ills attendant upon unbalanced air conditions in an air-starved plant should however be so obvious and so subject to your own dollars and cents evaluation as to make it relatively easy to put together a proposal that will get your management's o.k. on the purchase order for make-up air equipment.

Eugene A. Sloane

Editor

Meetings, Courses, Expositions

Industrial Heating Equipment Association, Inc. meeting, *Dearborn Inn, Dearborn, Mich., Jan. 23-24, 1961.*

Plant Maintenance & Engineering Conference, *International Amphitheatre, (White room discussion to be included) Chicago, Jan. 23-26, 1961.*

Air Cleaning Institute (lectures and laboratory sessions), *Harvard University School of Public Health, Jan. 30-Feb. 3, 1961.*

Air-Conditioning and Refrigeration Wholesalers (annual convention), *Chicago, Feb. 10-11, 1961.*

National Rural Electric Cooperation Assn. (annual meeting), *Dallas, Texas, Feb. 12-16, 1961.*

American Society of Heating, Refrigerating, and Air-Conditioning Engineers semi-annual meeting and exposition, *International Amphitheatre, Chicago, Feb. 13-16, 1961.*

10th Annual Industrial Ventilation Conference, *Kellogg Center, Michigan State U., East Lansing, Michigan, Feb. 20-23, 1961.*

11th Annual ISA Conference on Instrumentation for the Iron & Steel Industry, *Roosevelt Hotel, Pittsburgh, March 8-10, 1961.*

National Assn. of Corrosion Engineers (annual conference and Corrosion Show), *Statler hotel, Buffalo, N. Y., March 13-17, 1961.*

139th Annual American Chemical Society, *St. Louis, Missouri, March 21-30, 1961.*

National Assn. of Refrigerated Warehouses, Inc. and The Refrigeration Research Foundation, *Mark Hopkins Hotel, San Francisco, Calif., March 27-30, 1961.*

3rd Symposium on Temperature—Its Measurement and Control in Science and Industry, *Veteran's Memorial Hall, Columbus, Ohio, March 27-31, 1961.*

Gas Appliance Manufacturers Assn., *Boca Raton Hotel, Boca Raton, Florida, April 5-7, 1961.*

American Industrial Hygiene Conference, *Sheraton-Cadillac Hotel, Detroit, April 10-13, 1961.*

7th National ISA Symposium on Instrumental Methods of Analysis, *Shamrock-Hilton Hotel, Houston, Texas, April 17-19, 1961.*

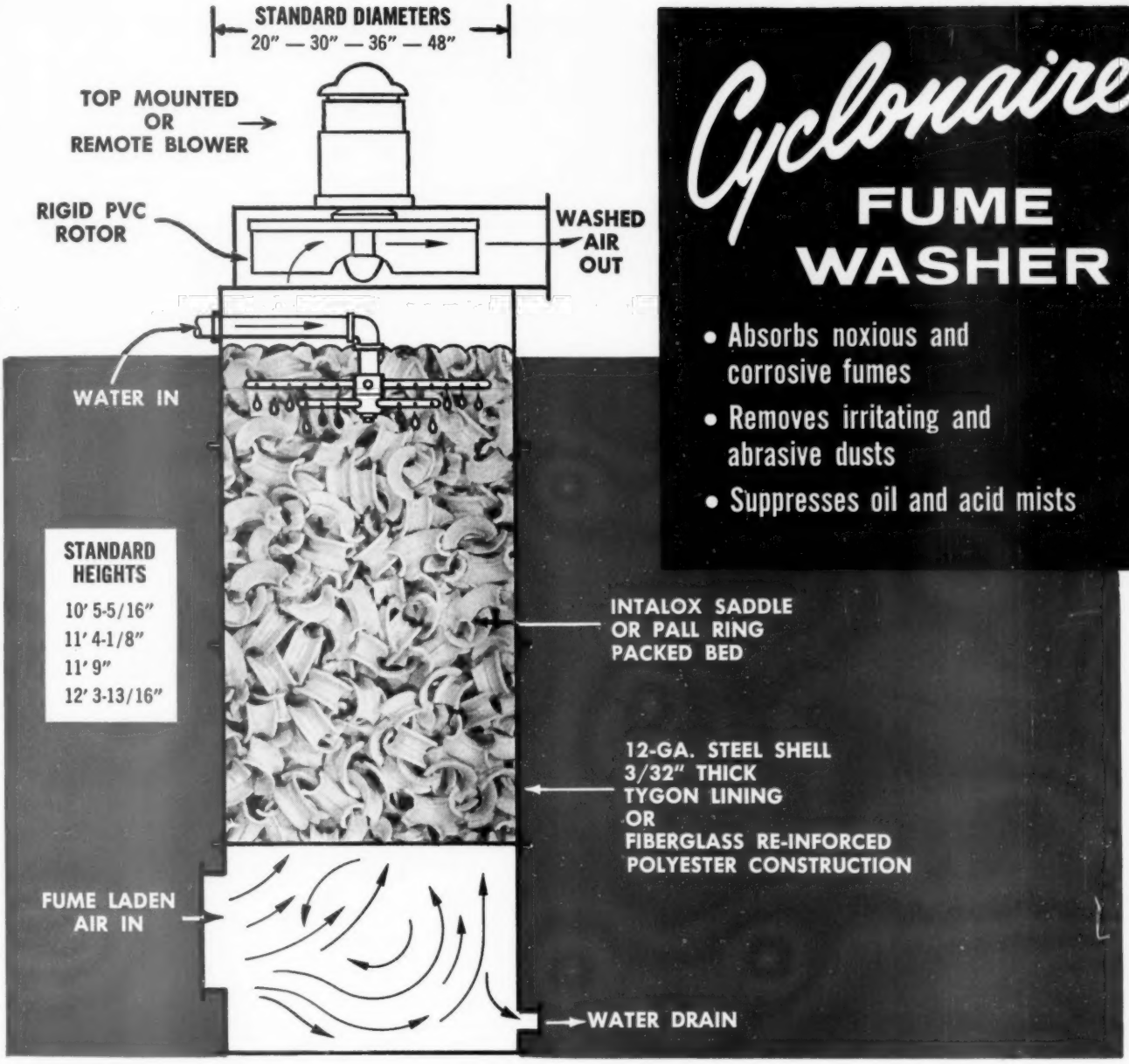
National Assn. of Electrical Distributors (annual convention), *Detroit, April 29-May 3, 1961.*

Consulting Engineers Council, *Chicago, Illinois, May 4-6, 1961.*

4th National ISA Power Instrumentation Symposium, *LaSalle Hotel, Chicago, May 8-10, 1961.*

Industrial Heating Equipment Association, Inc., *The Homestead, Hot Springs, Virginia, May 21-24, 1961.*

Air Pollution Instrumentation Symposium, *Hotel Commodore, New York, June 12, 1961.*



Cyclonaire FUME WASHER

- Absorbs noxious and corrosive fumes
- Removes irritating and abrasive dusts
- Suppresses oil and acid mists

The "Cyclonaire" is a surprisingly compact wet bed scrubber. It will fit almost anywhere, but it does a fume removal job formerly possible only with expensive custom-designed units. Removal of many gases (of 1% concentration or less) is up to 99% effective. Low power requirements make it very economical to operate.

The "Cyclonaire" is available fabricated either from 12-gauge steel, lined with 3/32" thick Tygon sheet plastic, or from fiberglass re-inforced polyester resin. The lined-steel unit comes complete with a top-mounted blower equipped with a rigid polyvinyl chloride (PVC) rotor. The lighter weight fiberglass re-inforced polyester unit utilizes a separately mounted blower duct-connected to the unit.

Both units are shipped complete with the necessary packing — Intalox porcelain saddles, metal or poly propylene Pall Rings—depending upon the corrosive conditions or weight limitations existing.

The "Cyclonaire" is available in four sizes with rated capacities of 750, 1650, 3500 and 6000 cfm.

Its low initial cost, its low operating cost, its high efficiency make the "Cyclonaire" a logical choice for a wide range of fume scrubbing operations. Full technical data in Bulletin FW-10R. Write for it today.

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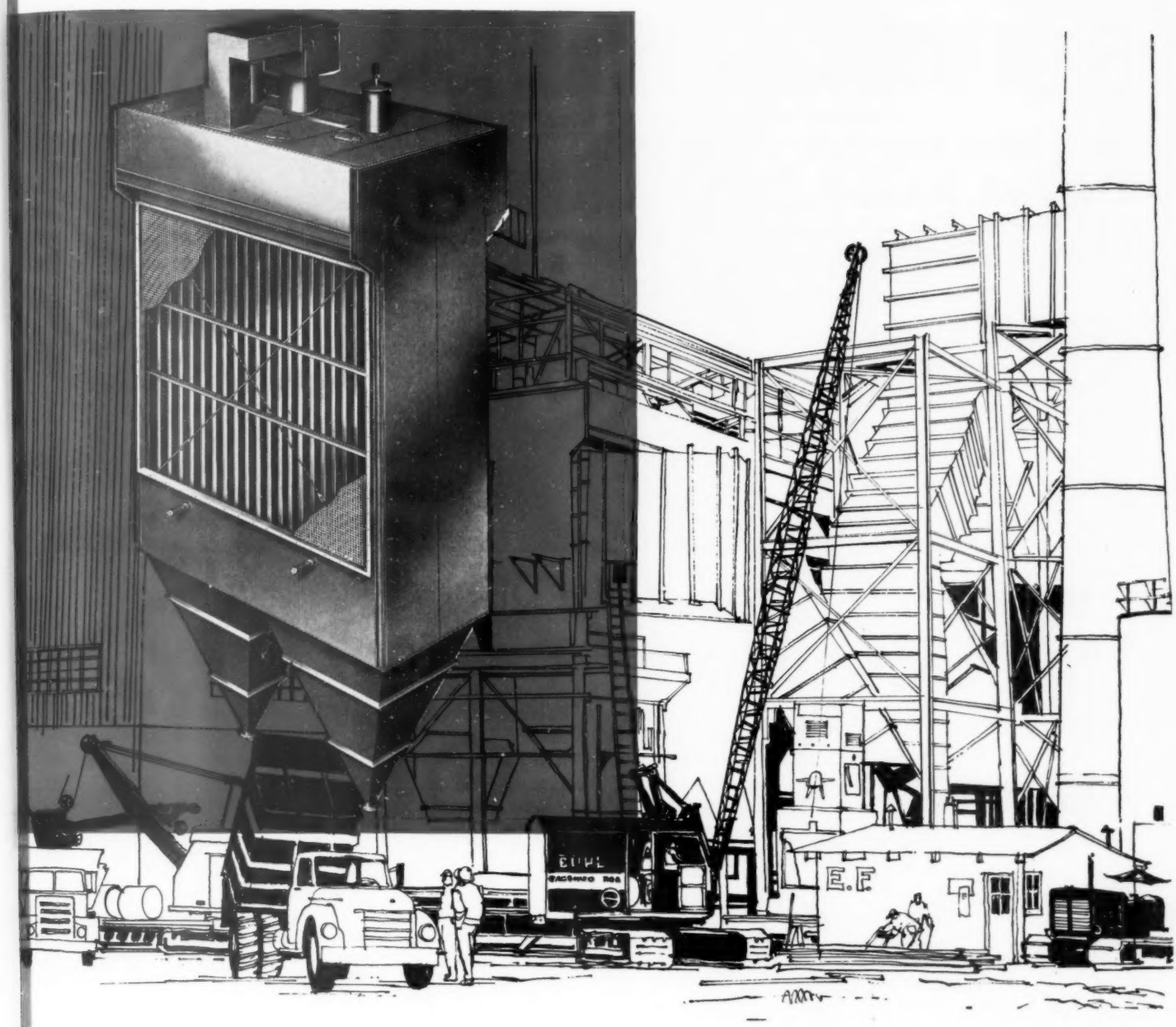
Improved collector plate design, factory pre-assembly that cuts field erection time, improved pneumatic or electric rapping, automatic voltage control, choice of high-voltage rectifiers

This is the new electrostatic

One of the most important features of our new electrostatic precipitator is the unique new collector plate. It is a flat plate to which we have added a "pocket" that traps dust, and reduces the chance of reentrainment. The new design also improves clean-plate sparking voltage, increases the migration velocity of particles, performs better with high



precipitator from American-Standard Industrial Division!

resistivity dusts, and makes rapping much easier. The choice of rapper is up to you; we offer both pneumatic and electric types. So is the choice of rectifier... silicon, selenium, high-voltage vacuum, or mechanical. Automatic voltage control is standard with all units. Factory pre-assembly is carried to the limit of practicality. Case in point: Structural frames, side casing, end panels, and hoppers arrive ready to drop in place. The result is faster, less costly field erection. For detailed information, call our nearest sales office and talk with one of our product specialists. American-Standard Industrial Division, Detroit 32, Mich. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario.

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INDUSTRIAL DIVISION

SALES OFFICES IN ALL PRINCIPAL CITIES

NEWS of the Industry

Army Develops New Pollution Detector

The Army Chemical Corps has developed a highly sensitive infrared "eye" able to detect minute degrees of air pollution at a distance of a quarter-mile. The instrument is sensitive enough to register a contaminant so thinly diffused that it is tasteless, odorless and invisible. In addition, it can distinguish one chemical substance from another.

The current model, called "Lopair," is intended primarily for troop use, but applications for air pollution studies and control of stack gases from factories is foreseen.

"The system," according to available data, "can detect and measure almost any substance by its characteristic infrared spectrum. Once the alarm has been properly set to detect one specific substance, normally it will not be set off by other materials likely to be present.

"A special design feature also prevents the alarm system from being set off when a person, animal or vehicle breaks into the infrared beam."

The chemical corps has also developed a similar device for detection of chlorine gas.

CEC Board Discusses Model Law

In November the Board of Directors of the Consulting Engineers Council met in Pittsburgh to discuss the problems of vital interest to consulting engineers.

The Board voted overwhelmingly to protest the portion of the recently-adopted Model Law on engineer registration which deals with corporate practice. According to the CEC Board, the majority of owners, principals, officers and stockholders of any corporation which offers engineering services to the public, should be registered engineers.

The problem of package deals, which many consultants oppose as unethical and not in the best interests of the client, was singled out for special attention by the CEC Board. Adopted by the Council was a resolution recommending that:

> ". . . conflict of interest between engineering and contracting for construction be avoided, so that the engineer can act solely in the interest of his client . . . and further, that any engineer engaged to provide engineering services for public work, have no financial interest in any firm bidding on, or in any way offering to contract for, construction of that project."

A valuable public relations aid for Consulting Engineers Council member firms was unveiled in the form of a special brochure entitled *Guide To The Preparation Of A Consulting Engineering Firm Brochure.* Purpose of the new publication is to assist interested Consulting Engineers Council members in the preparation of brochures describing the qualifications, size and experience of their firms. Reproduction of actual pages selected from a number of consulting firm brochures are used to illustrate the various recommendations contained in the Guide, available only to members of CEC.

(Please turn to page 14)

Ventilation Conference Set For Feb. 20-23, E. Lansing, Mich.

An unusually rewarding program is in store for those attending the 10th Annual Industrial Ventilation Conference, to be held Feb. 20 through Feb. 23 at Michigan State University, East Lansing, Mich.

If your plant has heating or make-up air problems, a need for better ventilation of fumes from such processes as plating or spraying, dust collection problems, you'll find this educational program most helpful.

Lectures and teaching sessions are divided into advanced and basic courses. For those plant engineers who want the fundamental knowledge that will enable them to design their own ventilation systems, the basic course will be most helpful. For those who want more advanced ventilation knowledge and who already know basic fan laws, duct design, etc., problem-solving sessions are programmed.

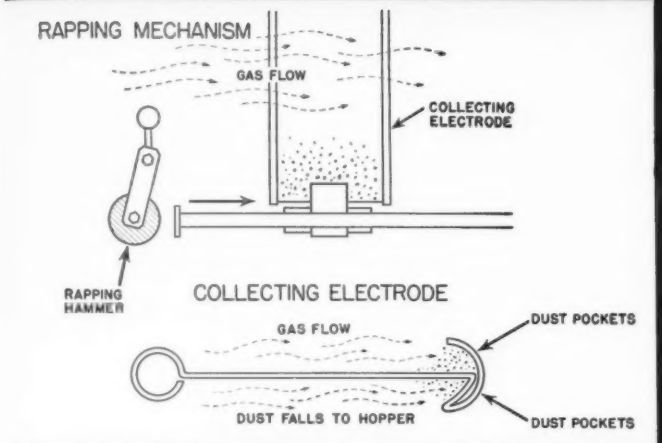
In addition to the teaching sessions, there will be demonstrations and lectures to be given to the entire group on balanced exhaust systems, good vs poor duct design, fabric collectors, fan demonstration, evaporative air cooling, radiant heating control, mine ventilation and mine fan regulation.

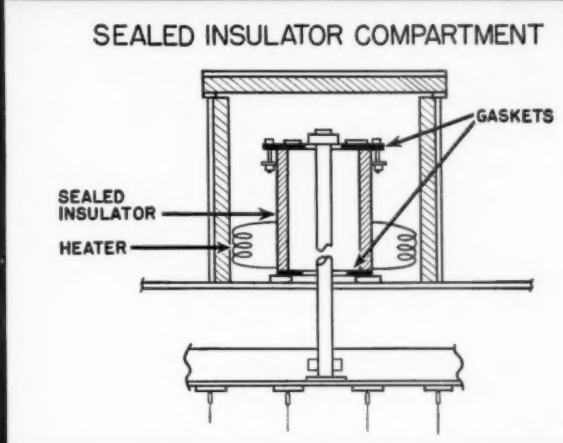
For more information and reservations, write to: James C. Barrett, Michigan Department of Health, Lansing, Michigan. Early registration is advisable because the course is limited to 250 persons.

SOME PLAIN FACTS

ABOUT SUPERIOR PRECIPITATOR PERFORMANCE

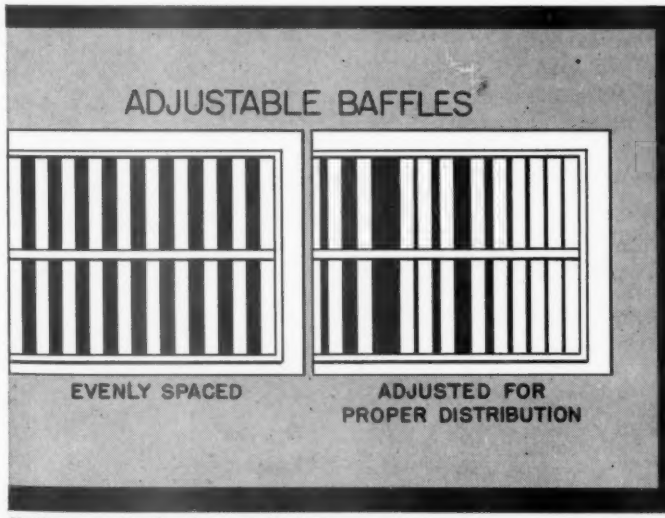
Buell Precipitators are designed and constructed for rugged service and superior performance. Frills and internal frim-fram of a doubtful value are eliminated in favor of strength and simplicity. The casing, outside supports, and internal parts are of rugged construction; and the four-point suspension of emitting electrodes ensures the greatest stability. Here are just a few of the outstanding features of Buell Precipitators.





Effective Continuous Cycle Rapping—Yes, it's mechanical. A simple, rugged system free of complicated gadgets; assures positive dust shearing action. Each row of electrodes is rapped separately—in the direction of the gas flow—on a continuous cycle. Dust is sheared off, drops in an agglomerated mass and pockets on electrodes minimize reentrainment.

Sealed Insulators Improves Operation—High voltage quartz support insulators are completely sealed; prevents gas and dust leaking into insulator compartment and outside air leaking into precipitator. There is no need for costly ventilating systems. Thermostatically controlled electric heaters insure start-up without danger of moisture condensation and insulator breakdown.



Uniform Distribution of Gas Flow—Field adjustment capability is vital. Buell's adjustable baffle permits final positioning after field measurement of actual flow distribution . . . because gas flow patterns are not entirely predictable. The Buell distribution system assures equal gas loading through the precipitator; eliminates ineffective "dead" areas around passages and prevents "sneak-by."

Buell Spiralectrodes cut maintenance to a minimum. Buell's record stands at less than 1% replacement in this key area. Self-tensioned spiralectrodes eliminate vibration and "off-center" swaying, often prevalent with weight-tensioned wires. They're structurally fixed and once installed stay in alignment. The spiralectrode provides greater emission than straight wires.

Buell precipitators are simple and effective. They're designed for continuous service. You'll be glad you turned to Buell when you experience superior performance and low maintenance. Detailed literature describing all features is available.

buell Norblo

The Buell Engineering Co., Inc., Dept. 62-A, 123 William Street, New York 38, N. Y. Northern Blower Division, 6417 Barberton Avenue., Cleveland, Ohio. ■Electric Precipitators ■Cyclones ■Bag Collectors ■Combination Systems ■Fans ■Classifiers.

NEWS of the Industry . . .

(Continued from page 12)

3 Motions Adopted by AMCA

R. W. Krogstad

At the recent Air Moving & Conditioning Assn., Inc. sixth annual meeting in Hot Springs, Va., attended by over one hundred AMCA members, representing sixty-six prominent manufacturers, three motions were formally adopted:

(1) Active support and promotion of AMCA activities and programs, including an expanded assurance program using Certified Performance Ratings based on AMCA Standard Test Codes; (2) a statistical services and communications program to establish economic trend data within the industry and provide member companies with a continuing flow of "up-to-the-minute" information on market conditions; and (3) a cooperative educational program, working through colleges and universities, to improve the overall understanding and technical knowledge of air moving devices and application.

Robert W. Krogstad was elected to the post of president. Krogstad is executive vice president and general manager, Carnes Corp.

Grants Given For Air Pollution Research

Air pollution research grants of $60,000 in cash and equipment valued at $45,000, were made by the independent Air Pollution Foundation recently in announcing plans for its liquidation early this year.

The Foundation granted $50,000 cash to Stanford Research Institute, together with an estimated $40,000 worth of equipment now being used in SRI's South Pasadena facility, for continued research in atmospheric chemistry.

A cash grant of $10,000 was made to University of Southern California for studies on air pollution, and equipment valued at $5,000 was turned over to Southwest Research Institute, San Antonio, Texas, for continued studies on automobile exhaust.

The announcement was made by Dr. Fred D. Fagg, Jr., president of the Board of Trustees, and Dr. W. L. Faith, managing director. Faith said the Foundation "will have fulfilled its mission by early 1961" and will be able to dissolve on schedule as predicted last November in the Foundation's 1959 Annual Report to trustees and contributors.

Coal Dust Expelled By French Method

Item from *France Actuelle:* "No longer will consumers ruefully have to watch (and breathe) coal's dust, thanks to Coal-Caso, a new liquid compound developed by France's Solvay Co. Sprayed under 22 pounds of pressure, four to six quarts of Coal-Caso completely seals in all dust on a ton of coal.

"At a recent conclusive demonstration in a big coal yard on the outskirts of Paris, sacks of coal treated three weeks earlier . . . were emptied out. No dust arose . . . Public health authorities are interested in the process because coal dust contributes heavily to air pollution in all the larger French cities."

Valcor Builds New White Room Area

For construction of close tolerance missile and aircraft components a new "clean room" will be built early this year for Valcor Engineering Co., Kenilworth, by Engineers Incorporated of Newark. Design is complete and construction began December 1.

Joseph A. Rosenthal, president of Engineers Incorporated, said such a clean room construction for industry is relatively new and poses a number of technical problems in both design and construction.

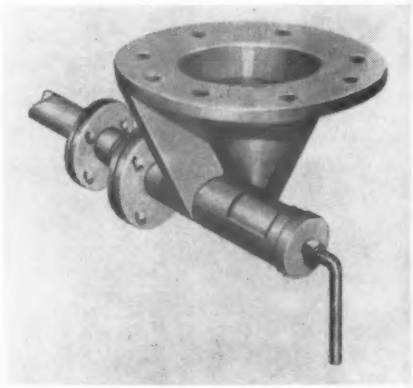
A "clean room" as its name implies, is built to exclude or minimize dirt and dust particles during construction of parts with very close tolerances. An air valve which will withstand pressures up to two tons per square inch and has tolerances of 15 to 20 microns will be the first project to be constructed in the new Valcor clean room.

The room must be airtight with an absolute filtration system for air conditioning and controlled humidity. Walls, floors and ceiling must have a hard surface which is easily cleaned. In the 20 foot by 15 foot clean room for Valcor, the walls are painted with glazed epoxy resins, ceilings are of hard plaster and floors vinyl tile. All fixtures are recessed and gasketed and wiring is completely concealed.

Workers enter the clean room through a double-door vestibule which has a footscrape floor surface, and don white smocks for working.

Correction

To clarify a reversal of U. S. Hoffman Machinery product pictures in the November and December New Products columns.



U. S. Hoffman Intake Valve

U. S. Hoffman Sani-Mop Vac System

NEWS of the Industry...

(Continued from preceding page)

Left: *V. G. MacKenzie (left), USPHS, discusses air quality standards with Dr. L. C. McCabe, Resources Research, Inc., and T. F. Hatch, University of Pittsburgh Graduate School of Public Health.*

Industrial Hygiene Group Relates Ventilation Study And Air Pollution

Air pollution control and its related problems was given considerable attention at the 25th annual Industrial Hygiene Foundation meeting, held at Mellon Institute, Pittsburgh.

Speakers directly concerned with the topic of air pollution were: Knowlton J. Caplan, Mallinckrodt Chemical Works, *How We Can Achieve Better Operation of Dust Control Systems;* William T. Ingram, chairman, Sanitary Engineering Division Committee on Atmospheric Pollution, ASCE, and consulting engineer, *Environmental Performance Standards Their Place In Planning and Zoning Regulations;* V. G. MacKenzie, chief, Division of Air Pollution, PHS, *Air Pollution Standards;* Roy O. McCaldin, Ph. D., Air Pollution Engineering Research, *Acceptable Equipment and Procedures For Evaluating Air Pollution Problems;* R. T. Pring, Manager, Dust Collector Sales, Dracco Division, Fuller Company, Cleveland, Ohio, *Recent Installations of Glass Bag Filters;* and H. Wilbur Speicher, Administrator, Industrial Hygiene, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania, *Plasma Jet.*

The following quotes are taken from the aforementioned topics, and are given as "highlights."

Legalized Air Standards?

● MacKENZIE: "While I doubt the wisdom of currently establishing legal ambient air standards prematurely in many areas where the proper technical association to local conditions have not been established, there is, in my opinion, no question as to the need to take all practicable steps necessary to lower the levels of air pollution in every American community having an air pollution problem.

"This can be done best, I believe, first, by continuing our current pragmatic practices of air pollution control based on the best technical judgments that can be applied to individual problems, and, second, by applying greater effort to improve our technical knowledge: (a) of ambient air quality requirements, and (b) of the specific relationships between ambient air quality and pollutant emissions in individual local situations.

"In this way we can take advantage of improved scientific knowledge as it is developed and avoid the risk of freezing controls and practices on the basis of incomplete scientific information."

Ventilation Background Needed

● INGRAM: "A background of knowledge of ventilation and air movement characteristics may be used to advantage in developing a comprehensive plan for the control of community and regional air pollution, and such plans may be aided by zoning which recognizes limitations on the capacity of air to receive and disperse atmospheric pollutants in conjunction with the placement of heavy manufacturing plants in designated areas.

"Noxious effects on neighborhood environment must be evaluated with full consideration of neighborhood acceptance. Levels performance should be related to community need and to basic requirements of health and safety."

Selecting Instruments

● McCALDIN: "When choosing equipment to make air quality measurements it is necessary to estimate the possible pollutants as well as the degree of accuracy and thoroughness with which they must be measured.

"Availability and reliability of equipment, cost of operation, and skill required for satisfactory results are also factors to be considered in equipment choice. Air pollution investigations have not yet reached the point where 'standard' measuring equipment is used although certain types of measurements and techniques are frequently used in evaluating certain qualities of the atmosphere."

6 Steps For Dust Control

● CAPLAN: "The steps in obtaining better operation of dust control systems can be summarized as six: (1) Management must decide and direct that you are going to obtain the return, even though intangible, from the capital invest-

(Please turn to following page)

News of the Industry . . .

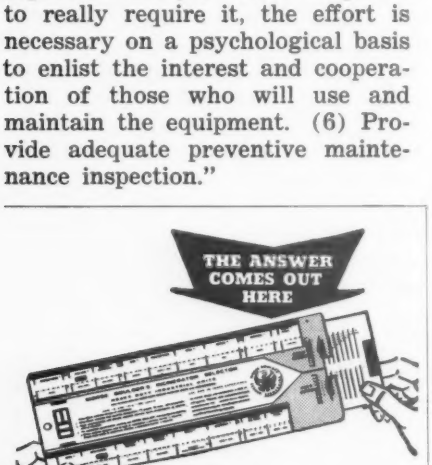
(Continued from preceding page)

Industrial Hygiene Group

ment made in dust control system.

"(2) Design the system with proper attention to details and tricks of the trade which will minimize maintenance. General rules are very hard to develop for this effort, and extensive experience with the peculiar problems of the particular industry is invaluable. (3) Design the system with adequate thought to initial installation of devices, gages, access platforms, etc. to make inspection and maintenance quick and easy.

"(4) Test the system as adequately as possible before putting it into operation and correct all defects. (5) Educate the users and maintainers of the system by both written manuals and verbal training sessions. Even if the technical aspects of the job are so simple as to really require it, the effort is necessary on a psychological basis to enlist the interest and cooperation of those who will use and maintain the equipment. (6) Provide adequate preventive maintenance inspection."



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Air Pollution Control Association

Precautions For Plasma Jet

● SPEICHER: "There are several precautions that should be considered during the use of the plasma jet.

"Several modes of operation cause excessive noise which needs control. Either the operation should be placed in an appropriate acoustic housing or perhops should be provided with ear protection. An octave band analysis for one mode of operation using nitrogen gas at a flow rate of 150 cubic feet per hour, and a D.C. arc current of 400 amperes and 40 volts was as follows:

Frequency Range Cycles Per Second	Decibels
20 - 75	78 ± 1
75 - 150	83 ± 1
150 - 300	80 ± 1
300 - 600	91 ± 2
600 - 1200	93 ± 1
1200 - 2400	98 ± 1
2400 - 4800	104 ± 1
4800 - 10KC	110

Another mode of operation using a long flame and helium gas at a flow rate of 40 cubic feet per hour generated only a noise level of about 80 decibels on the C scale of a noise meter.

"A number 6 shade welding plate mounted in a coverall goggle or welding helmet usually provides satisfactory protection to the eyes and permits adequate vision of the operation by the operator.

"When some gases such as argon are used the ultraviolet intensity is sufficient to produce irritated exposed skin to persons adjacent to the operation.

"Fine hot spray particulate material should be removed from the breathing zone of the operator and adjacent workmen. The oxides of nitrogen concentration may exceed 5 ppm within one or two feet from the jet unit.

"Local exhaust ventilation is desirable for removing both toxic gases and particulate matter from the breathing zone of the operator and adjacent workmen."

Hi-Temp. Glass Bag Use

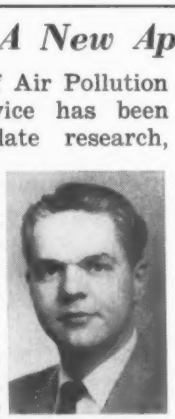
● PRING: "The silicone treatment of glass fabrics plus the development of reverse air cleaning techniques have created great opportunities for the useful application of glass bag filters. Sonic cleaning of glass bags represents a further technological advance permitting reduced bag wear and lower operating pressure drops. Top entry filters may or may not prove advantageous, as compared to conventional bottom entry designs, but at least their relative merits are being studied on a commercial scale. As time goes by, it is inevitable that further improvements in bag filter design and filter fabrics will be made.

"Dracco has in production the first glass bag filter for cleaning hot-charge open hearth steel furnace gases. This unit, to be placed in operation in early 1961, will filter 125,000 cfm at 525°F.

"Another key installation of glass bag filters is at Hudson Bay Mining and Smelting Company, Flin Flon, Manitoba. Here gases from copper reverberatory furnaces and converters leave an electrostatic precipitator at 800°F, are cooled in U-tube coolers to about 450°F and then passed through a 120 compartment glass bag filter equipped with our special 'Swing-Clean' shaker mechanisms. The bags in this case are 5″ diameter by 9′-3″ long and even with mechanical shaking, have exhibited satisfactory service life during the four years the installation has operated. The capacity is 205,000 scfm."

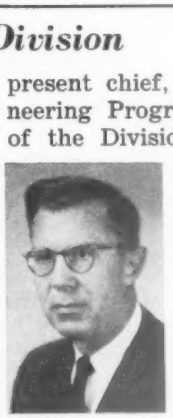
PHS Creates A New Ap Division

A new Division of Air Pollution in the Public Service has been formed to consolidate research, technical assistance and training activities carried out since 1955 by Air Pollution Engineering and Medical Programs.



Prindle

Deputy chief will be Dr. Richard A. Prindle, PHS career medical officer and present chief, Air Pollution Engineering Program. Assistant chief of the Division will be Ralph C. Graber, engineer and PHS career officer. He is present chief, Air Pollution Engineering Program.



Graber

This was previously announced in our October issue, but Mr. Graber and Dr. Prindle were listed incorrectly.

? ? ? ? ? ? ? *Questions & ANSWERS* ? ? ? ? ? ? ?

$25.00 For Best Answers To White Room Questions

A late evening bull session at a recent symposium on White Rooms at the University of Arizona produced a string of interesting questions on room design and operation.

To those of our readers who design, build and/or operate white rooms we will pay $25.00 for the best set of answers to the questions posed below. We will also pay $5.00 for the best answer to single questions.

Here Are The Questions

1. What is the preferred method of running utilities (air, electrical etc.) in white room areas in order to provide maximum flexibility for future layout changes?
2. Has anyone used suspended floor construction to provide crawl space for utilities distribution?
3. How satisfactory is translucent plastic ceiling with light fixtures and sprinkler heads suspended above?
4. Could plastic material be used with the "Air-Son" type of air distribution?
5. What is most satisfactory material for floor and walls for use with chlorothene and cobehn solvents?
6. What has been found to be the most satisfactory general lighting intensity for bench assembly *without* local lighting. What is the best ratio of lighting intensities when using both local and general lighting?
7. What is the latest equipment for dust particle monitoring? I believe we would prefer a continuous monitoring system to reflect changing rather than the sampling type of system.
8. What is the most satisfactory type of air distribution? Are ducts preferred over the bleedout system where air is left to escape under door openings?
9. How many companies use music in their plants, particularly in the white room areas? Are intercom systems in white areas considered a basic necessity?
10. a. What is the preferred height for outside window viewing?
    b. What is the preferred ceiling height?
11. What bench design is preferred?
12. a. What is the preferred method for cleaning white areas (vacuuming, damp mopping, or other)?
    b. Are static collectors used to concentrate any local dust collection?
    c. I would like to see a general consensus of opinion on the most efficient air filtering system in use today.
13. Are built-in storage facilities used in white areas and who makes such equipment?
14. Are there any particular personnel problems that companies have encountered in the operation of white rooms?

Questions "Fingerprinting" Dust Article

The article by Mr. David Hoffman, on page 51 of the Oct. 1960 issue, is a very fine summary of the work which has been done in order to determine the source of particle contamination within the plant.

We note that there is a somewhat elementary attempt at using the method outlined in our article for identifying particulate matter. The author describes the particulates under the microscope as "white plastic-like, shiny metallic-like, dull metallic-like, and fibers." This is the beginning of classifying particles by their morphology, and it is in this analysis that Mr. Hoffman's paper parallels ours.

(Mr. Salzenstein's article is on page 31 of the Jan. 1960 issue.)

I find it difficult to understand the conclusions made as a result of the work described in the paper. The only data taken on the indoor dust which can be correlated to data taken on the outdoor dust seems to be the spectographic analyses. The conclusion made that a large portion of the airborne dust inside the factory comes from the immediate area outside the factory simply is not supported by the data presented in the article.

Marvin A. Salzenstein
Research Engineer
Walter C. McCrone Associates
Chicago

In Reply To Mr. Salzenstein

I wish to express my appreciation to Mr. Salzenstein for his comments on "Fingerprinting Airborne Dust" (p. 51, October, 1960).

Mr. Salzenstein states that "the only data taken on the indoor dust which can be correlated to data taken on the outdoor dust seems to be the spectrographic analyses. The conclusion made that a large portion of the airborne dust inside the factory comes from the immediate area outside the factory simply is not supported by the data presented in the article."

In reply I present the following two tables and several rationalizations.

In Table I there are two of the seven size ranges that do not "correlate" within the standard deviations (σ); the 32-85μ and

(Please turn to page 51)

TABLE I
PARTICLE SIZE DISTRIBUTION

SIZE RANGE (microns)	OUTSIDE FACTORY (% of total)	INSIDE FACTORY (% of total)	σ (% of total)
1-16	60.8	65.9	5.2
16-32	24.7	19.3	2.8
32-85	12.4	8.0	1.8
85-230	2.0	1.9	1.0
230-460	0.0	0.4	0.4
460-920	0.0	0.8	0.7
920	0.1	3.7	0.9

TABLE II
PARTICLE TYPE DISTRIBUTION

CATEGORY	OUTSIDE FACTORY (% of total)	INSIDE FACTORY (% of total)	σ (% of total)
white plastic-like	36.4	41.5	7.4
dull metallic-like	3.8	6.4	4.2
shiny metallic-like	16.2	28.8	5.7
miscellaneous	43.5	17.9	4.8
fibers	0.1	5.3	1.6

AT HIGH TRAFFIC DOOR . . .

Air Curtain Improves Plant Heating

by Roy K. A. Bjorkman*
Process Engineer,
General Electric Co.,
River Works, Lynn, Mass.

Where rail and truck traffic frequently enter plant, an air curtain in place of door can hold back wintry blasts, keep plant area from up-and-down temperature conditions. Article gives air curtain design data.

Fig. 1: *This door, in a new manufacturing bay, is used frequently, and would have led to inrush of cold air blasts during wintertime if air curtain had not been used.*

BLASTS OF COLD, winter air from a frequently opened large door (Fig. 1) leading to a new manufacturing bay would have caused up-and-down temperatures that affect comfort and production in our plant.

Main rail and truck traffic were to pass through this door, which opens to a main manufacturing bay.

An outer vestibule was considered, but track limitations, clearances and underground services made its construction impossible. Besides, any such structure would have to be designed to use a minimum of valuable space inside the building.

Another problem was posed by an existing negative pressure from connecting manufacturing bays, plus the size of the door opening, which would require a radical change from standard design of unit heater banks, high velocity air streams and the like. From experience with similar situations, we have found these solutions to be unsatisfactory.

With these considerations in mind, we turned to an air curtain as the best solution for this problem. The door could be opened and closed frequently or left open, and the air curtain would keep out cold air, help maintain even temperatures in the manufacturing bay and eliminate banks of unit heaters, etc., which would have been less practical.

For example, a similar door, at the east end of this building (Fig. 2), but with minimum usage, is protected by a standard heat diffuser rated at 15,500 cfm. The three cowls on this unit are ducted to a discharge nozzle 18 ft. wide by 6 in. cross section, giving a discharge velocity of about 1700 fpm. It was found that this application is fairly satisfactory with still air conditions outdoors, but with even a relatively mild breeze, little protection against cold air blasts into the plant area is obtained.

Briefly, the air curtain installation consists of an insulating barrier of heated air, directed vertically downward over the face of an 18 ft. x 18 ft. door.

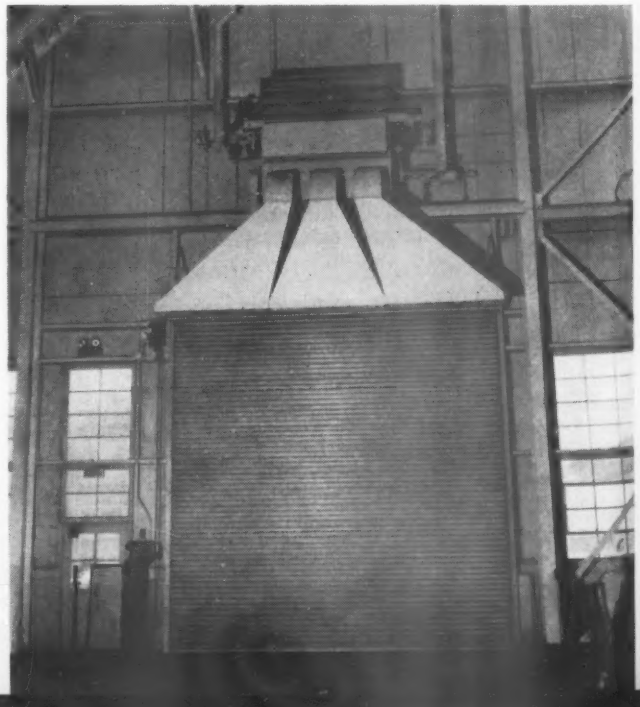


Fig. 2: *Right, an older door with a conventional blast heater. Cold air goes right through downblast from this heater, brings chills to men and machinery.*

Fig. 3: *Nozzle section of air curtain at top of door. Angle of discharge is automatically adjusted according to outside wind pressure.*

Its effectiveness is based on two principles: First, the depth of the air mass as evidenced by the 7 ft. wide intake at floor level, and second, the angle of discharge from the nozzle section at the top of the door which is automatically adjusted according to wind pressure.

Air is circulated using four fans, each rated at 30,000 cfm and driven by 20-hp motors. The plenum pit under the door has a 7 ft. x 7 ft. cross section and is 33 ft. long as it must pass under a pedestrian door. Actual intake grid is 19 ft. long. Automatic sprays are used to wash down the pit periodically, and accumulated water is pumped to a sanitary drain. Overall dimensions are 31 ft. high x 35 ft. wide x 7 ft. deep.

Installation of the air curtain was resolved into two (2) operations. First design and fabrication of equipment and installation on the site; and second, design and installation of the foundation, plenum pit, and services. This latter and Project Engineering was by General Plant Utilities–Plant Engineering & Construction Unit.

Operating Experience

Very definitely, the success of the air curtain is contingent upon the depth of cross section and the variable angle of discharge. Previous installations, using large quantities of high velocity high temperature air discharged from a plenum through a narrow nozzle, have not proved too successful, especially under a combination of wind exposure and negative pressure within the building.

The seven foot depth of the curtain of air, together with the variance of angular discharge, has proved successful in this installation. There is induced penetration of outside air into the heated air discharged from the nozzle, but a major portion of this is spilled outside (Fig. 4). Similarly, inside air is induced into the air stream and spilled back into the building at floor level. Theoretically, with no wind and no negative pressure, the same air should be repeatedly

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**Associated with the plant engineering and construction section of the medium steam turbine division. Ten years experience working with process equipment, air conditioning, heating and ventilation installations. Registered Massachusetts professional engineer and member of ASHRAE.*

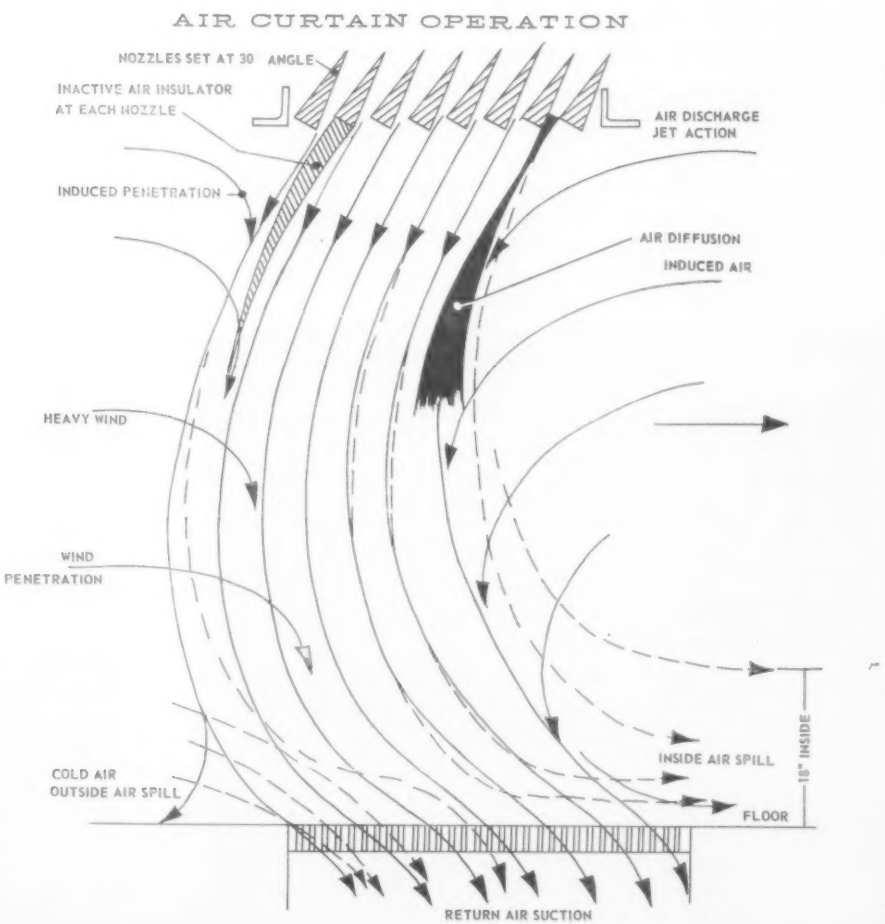

Fig. 4: *Right, air curtain operation. Induced penetration of outside air into heated air from nozzle is negligible, most of it being spilled outside.*

(Continued from preceding page)

recirculated with no heat required. However, due to our negative pressure, outside air is induced into the air stream, mixed, heated, and spilled back into the building. As this is warm air, however, it is not objectionable.

Steam service was originally layed out to utilize both exhaust and reduced pressure, with valves operating in sequence. Due to distribution difficulties, however, both valves are now on 20 psig steam, reduced from the 200 psig manufacturing line, and sequence changed to parallel operation.

In working out the "bugs" after door was in operation, it was found necessary to reduce speed of the fans due to the deflection of high velocity air against the grating, which caused a large volume of inspill into the manufacturing area.

Original specification of blowers called for 32,000 cfm at 3 in. static pressure. Actual readings taken determined that a static pressure of 1½ in. was sufficient. Consequently, the fan speed was reduced from 1330 rpm to 1070 rpm. Load readings showed a reduction of approximately 50 percent on hp needs.

It was also found that a temperature differential of approximately 20° existed from one side of the discharge nozzle to the extreme end. This was solved by using air baffles in the return ducts to allow more air flow to fan sections on high temperature side.

From conception to finish, installation was completed in 14 weeks. Some minor changes and improvements were required after operation and design checks and at present, after two heating seasons, the installation, as a whole, is considered to be very satisfactory. ▲▲

DESIGN AND COST DATA ON AIR CURTAIN INSTALLATION

1. *Initial Design Data:*
   Building interior temperature—70°F.
   Prevailing wind—10 mph, N.W. (exposure S.W.).
   Negative pressure 0.10 in.
   Design outside temperature—0°F.

2. *Air Curtain Design:*
   Coil capacity—1,500,000 Btu.
   Fan capacity—112,000 cfm—1.5 in. sp (4 units, 28,000 cfm each).
   Drive—four 4) 20 hp—1800 rpm motors.
   Angular discharge—0°.

3. *Controls:*
   a. A 5-second delay on door opening to allow fans to reach full speed and steam valves to open initially (30-second valves). The operation of the blowers is timer sequenced at approximately 2 second intervals to prevent overloading the power circuit.
   b. A modulating control to hold temperature at 100°F in plenum when door is in closed position (keeps steam in coils).
   c. Two (2) steam valves in parallel go to full open on energizing of door.
   d. A thermostat in the nozzle discharge is set at 100°F to operate when door opens.
   e. A high temperature purge control energizes one fan when plenum temperature reaches 110°F for protection of motor and drive belts.
   f. Nozzle direction is controlled proportionately with amount of wind velocity and inside negative pressure.

4. *Operational Check:*
   Nozzle discharge velocity...3500-4000 fpm
   Nozzle discharge temperature .....100°F
   Grate air temperature..... 85°F
   Grate intake velocity.....1000-1400 fpm

5. *Initial and Operating Costs:*
   Total cost of installation was approximately $60,000 due to the custom design, necessity for heavy structural floor grate supports, initial investigation, etc. We believe a duplication of the installation could be reduced by at least 25 percent. Operating costs, electrical and steam, approximately $1500 a season.

6. *Construction Details:*
   Pit under the door is 35 ft. long (which includes a pedestrian door) and has a 7 ft. x 7 ft. cross section.
   Actual grating at the door itself is 19 ft. long x 7 ft. wide, of heavy-duty construction to carry maximum track load. Grate is supported by 6 in. I-beam 24 in. on center. Overall dimensions are 31 ft. high, 35 ft. wide, 7 ft. deep.
   The fan plenum section is 35 ft. long by 7 ft. high. The coil section and nozzle section are 3 ft. high respectively.
   The two return columns are 5 ft. x 7 ft. and actually support the overhead construction. Bottom of duct is ¼ in. plate for protective purposes, the upper sections being 10 gauge HRS. The actual opening is 18 ft. high x 19 ft. 4 in. wide.
   The pit is furnished with screens and baffles in front of the duct risers and has an automatic spray unit to keep the dirt and dust down which would be normally recirculated.

EQUIPMENT CREDITS

Blowers—*Buffalo Forge Co.*
Coils—*Marlo Coil Co.*
Motors—*General Electric Co.*
Controls—*Minneapolis-Honeywell Regulator Co.*
Air Curtain Design—*American Air Curtain Corp.*
Air Curtain Installation—*The McMurrer Co., Boston, Mass.*
Site Preparation—Services, and Project Engineering General Electric Company — River Works Plant Engineering & Construction Unit.

Before you invest in these units, you should know

Power and Space Requirements For Electrostatic Precipitators

Before making a decision about electrostatic precipitators, you will need this information about their space and power requirements for gas cleaning.

by R. A. Denbroeder
Manager of Engineering, Industrial Gas Cleaning Department, Koppers Co., Inc.

In this and subsequent articles, we will demonstrate what determines the space and power requirements for electrostatic precipitators. Our information is directed towards plant engineering personnel who will be most likely to make decisions relating to the selection of this equipment. Factors leading to equipment choice are diverse and will be developed in detail in the following issues. This introduction will be utilized to "set the table" by presenting the broad picture.

There are three primary conditions that determine the size of precipitators required for a given installation. First, gas volume required to be cleaned; second, the efficiency that must be achieved; and, third, the physical layout required by the arrangement of the adjoining equipment.

These primary factors are also influenced by secondary conditions. Volume, of course, is directly related to temperature. The difficulty of achieving the desired efficiency is influenced by the dust loading and particle size in the gas stream. The geometry of the layout is affected by a multitude of factors, one of which is the location of other more important equipment in the immediate area.

It is extremely important that information as correct as possible be made available to the precipitator manufacturer so that correct sizing may be accomplished. Frequently, the tendency is to set the conditions unnecessarily high, thus causing the precipitator manufacturer to ask for more space than would otherwise be required. The purchaser feels that he must "play it safe," which of course he should, but not to the point of penalizing himself by allocating more space than necessary for a function that in many cases adds nothing to the productive performance of his plant.

Most precipitator engineers are available and willing to assist in arriving at the most desirable specification for a given process. Nearly always, previous experience has been acquired on a similar application and valuable aid can be provided to the uninitiated with the resultant saving to the user.

There are certain variables of size of the precipitator equipment that can be adjusted at the time. The width and height relationship may be varied to permit the geometry of the equipment to fit more readily the space available. It may also be possible to reduce height requirements by substituting scraper bottoms for hoppers in certain applications. Difficult duct arrangements may be tolerated when advisable,

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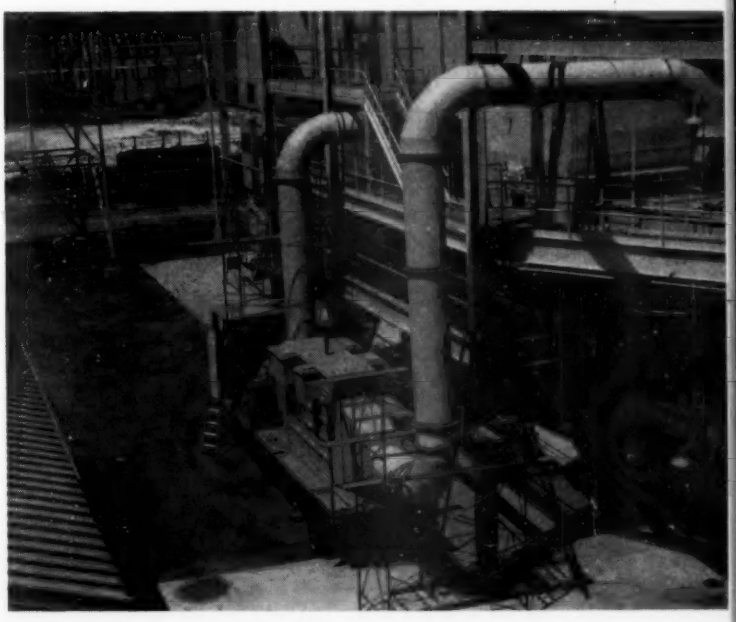

Fig. 1: *Mobile pilot precipitator used for detailed study of precipitator parameters.*

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providing a flow model study is made to provide for necessary corrective devices to insure proper gas distribution to the precipitator. The additional expense of such a study may return dividends of many times its cost in space saved for use for other equipment.

Power Requirements

While the foregoing has been related to space conservation, it is important to note that power requirements are usually directly related to the size of the equipment being installed; thus any factor that affects the size of equipment also affects the power requirements. We previously mentioned model studies as providing more compact duct arrangement for better space utilization. It should, however, also be realized that better distribution of the gas stream to the precipitators also results in the use of smaller equipment and likewise less power.

Another vital point contributing to the reduction of space and power requirements for precipitators is the manufacturer's constant search through research and development programs on all facets of the equipment for more efficient functional and physical components. Such components, for example, as collecting and discharge electrodes, have undergone considerable change and improvement over the years. Studies on these important items, along with other components such as rapping systems, power supplies and power controls, to mention a few, continue.

An excellent illustration of the effort of precipitator manufacturers to improve their technology is the mobile pilot unit being utilized by Koppers Company at present in the power generating industry for the purpose of determining ways of projecting more accurately the equipment required for a given situation. This unit is a complete precipitator in miniature having its own rectifiers, controls, dust handling system, air compressor and other required equipment. The various parameters affecting precipitator performance may be varied and controlled to an extent not previously possible. This program alone should result in the use of smaller equipment on many future installations.

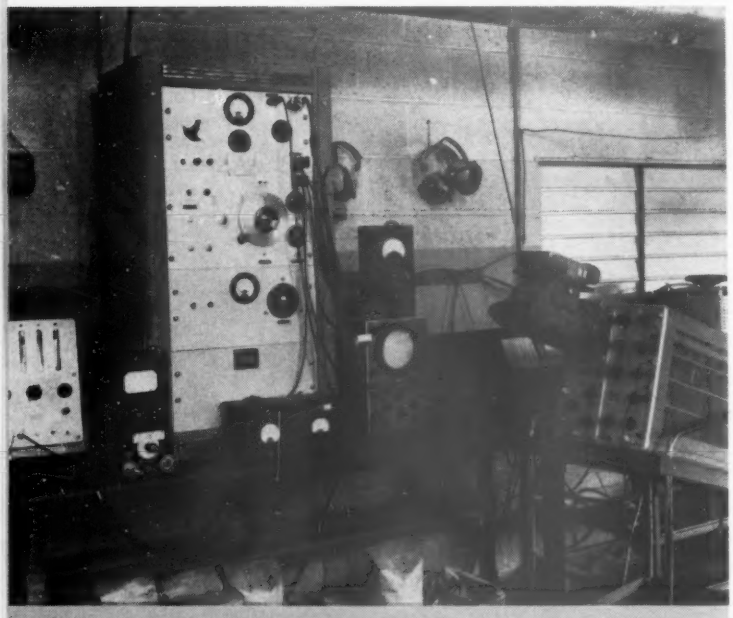

Fig. 2: *Some of the instrumentation used in a research and development laboratory for study of precipitator problems.*

An ever continuing search is being carried on to improve the functional and mechanical properties of collecting electrodes. There has been a continuous change in this important component through a variety of materials and configurations. Collecting electrodes have been made of cast concrete, perforated and expanded materials of many varieties and formed and flat sheets. The progress with this one component has contributed greatly to space requirement reduction and to a secondary benefit of lighter equipment.

An equally important component is the discharge electrode which is considered by many to be the heart of the precipitator operation. As with the collecting plates, this item has run through a tremendous range of configurations including wires, square and round, twisted and straight, to mention a few.

The changes to these collecting and discharge electrodes have contributed greatly to the size reduction of the present day precipitators, and will undoubtedly lead to more economical space utilization in the future. An indication of this is now evident in the use of controlled corona discharge electrodes which are now being offered in some precipitator applications.

Another development by the precipitator manufacturers that has contributed to the more efficient utilization of the equipment has been the automatic power control. This device permits operation at the maximum permissible power level at all times. Previously, it was necessary to maintain a maximum operating level equal to the lowest setting of the power equipment that could be maintained throughout the entire cycle of the process.

In the foregoing we have briefly pointed out a few of the many factors influencing space and power requirements for electrostatic precipitators. Subsequent articles in this series will explore in greater detail many of the points touched on here as well as other factors which contribute to space and power determination.

Titles and authors of the succeeding articles are: *Functional Factors,* E. P. Stastny, Chief Project Engineer; *Physical Factors,* R. L. Brown, Senior Contract Engineer; *Power Requirements,* E. S. Snader, Senior Electrical Engineer; and *Duct Design and Gas Distribution,* V. A. Jordan, Senior Technical Engineer.

This new steel mill displays how

Modern Steel Plant Gets Ultra-Efficient Heating

by Charles H. Smith*
L. J. Wing Mfg. Co.

Today's management can be sold good heating and ventilation because it prevents absenteeism, turnover, and improves employee efficiency. What this new steel mill did, you can do in your own plant.

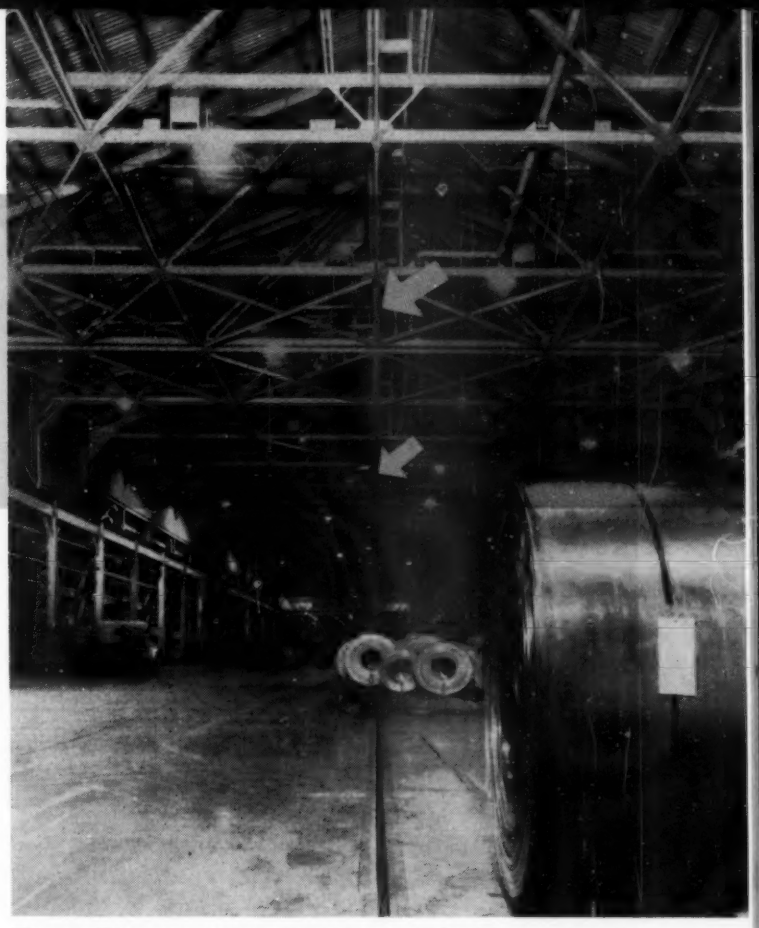

Fig. 1: *This view shows expanse of steel mill area covered by unit heaters (arrows). From truss area between 40 to 69 ft. above floor, heaters handle building width of 106 ft. to 126 ft.*

ONE OF THE MOST IMPORTANT areas of study by steel company air engineers is that of heating and ventilation. It is becoming increasingly apparent that if employees are furnished with comfortable and healthy working conditions, there will be less absenteeism and turnover and also increased production by workers on the job. Heating and ventilation are important factors in providing these better, more healthy working conditions.

An excellent example of this up-to-date philosophy is a new cold strip mill recently completed by a Midwestern steel producer. Not only is it modern in layout and equipment, but it is planned to provide working conditions substantially superior to the average in the industry. The change house is equipped with a filtered forced ventilating system and all mill offices are air conditioned.

Probably the most significant contribution to good working conditions in this mill is the heating and ventilating system. Designed to bring in a complete change of air every hour, summer or winter, the system maintains uniform, comfortable temperatures throughout the entire mill, with neither hot nor cold spots, and without cold drafts in cold weather. Comfortable working temperatures are maintained throughout the winter, despite the mill's exposure to cold, bitter winds.

This mill consists of eight adjacent main mill buildings, mostly open to each other where they adjoin. They cover approximately 850,000 sq. ft. of area . . . about 20 acres. Overall width of the area is 686 ft., and overall length, 2472 ft. If all the buildings were put end-to-end, they would extend more than one and one-third miles.

There were several major objectives in designing the heating and ventilating system. First was the furnishing of a continuous, positive supply of fresh air throughout the mill buildings, summer and winter. Second was automatically maintaining comfortable and uniform temperatures over the entire mill floor area, without the usual hot and cold spots or blasts that occur when heat distribution is not uniform.

Other considerations were the design and location of the heating units to avoid cluttering the floor and column areas with ductwork and piping or causing of crane interference. The use of a minimum number of heating units to simplify maintenance and inspection was also important. These objectives were met by the choice of overhead, downblow revolving-discharge unit heaters, installed in the roof truss area, complete with catwalks and service platforms—and by the use of both power and gravity roof ventilators.

Fig. No. 1 shows a view down the No. 2 coil storage floor, giving an idea of the expanse covered by the heater units. From the truss area, at heights between 40 and 69 ft. above the floor, the units cover building widths of 106 ft. in the case of 5 buildings, and 126 ft. in the other three. Units, indicated by arrows, are located in a line down the center of each building. Note how heater mounting in the truss area avoids cluttering the floor and column areas with

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**Based on a paper presented to the Association of Iron and Steel Engineers Fall Meeting, with permission of AISE.*

Fig. 2: *Typical unit heater installed above a 56-in. tandem mill. Discharge velocity brings air to working level from truss heights.*

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expensive ductwork and piping. The only ducts are short runs connecting the fresh air heater inlets with roof openings shown in the photo. Bottoms of the heater discharges are just above the bottom chord of the trusses, and provide adequate clearance for the cranes.

In Fig. No. 2 we see a typical unit, in this case installed above the 56-in. 4-stand tandem mill. Each unit's discharge velocity is adequate to deliver air to the working floor from 40 to 69 ft. up. By the time air reaches the floor it is well diffused, producing gentle moving currents. The revolving discharge feature makes it possible to locate heaters and machinery and other solid objects without concern about the blocking of air flow. Since air discharge direction slowly but continually changes, there are no areas subjected to uncomfortable fixed streams of hot air from heaters, and no areas left "out in the cold." Absence of cold spots avoids condensation of moisture on material in storage.

Fig. No. 3 shows a typical heater installation. We can see the access platform, the revolving discharge and its out-of-the-way location up in the trusses. Actually, two different types of heaters were selected for the system; the fresh air supply, and the recirculating type. Fresh air units bring in outside air and heat it. Recirculating types recirculate inside air and heat it as necessary to make up heat loss from the building.

Use of recirculating heaters, in addition to fresh air supply units, makes possible the return and redistribution of any hot air accumulating under the roof. This keeps the temperature differential between floor and roof to a minimum, thus reducing heat loss through the roof. Should the steam supply be reduced or impaired, all units can operate on recirculation and thus reduce the steam needs.

Fig. No. 4 identifies the eight buildings which make up the cold strip mill. The structure housing offices and the change house is not considered in this paper, since it has its own separate heating, ventilating and air conditioning system. The other eight buildings have no windows and most have no convection air openings in the sidewalls. Neither the heating and ventilation, nor the illumination systems need to be supplemented by windows or the usual number of wall openings, and so construction was simplified. All of the mill roofs are insulated, primarily to reduce condensation, but also to reduce heat loss. Side walls are not insulated except for those of the roll shop building.

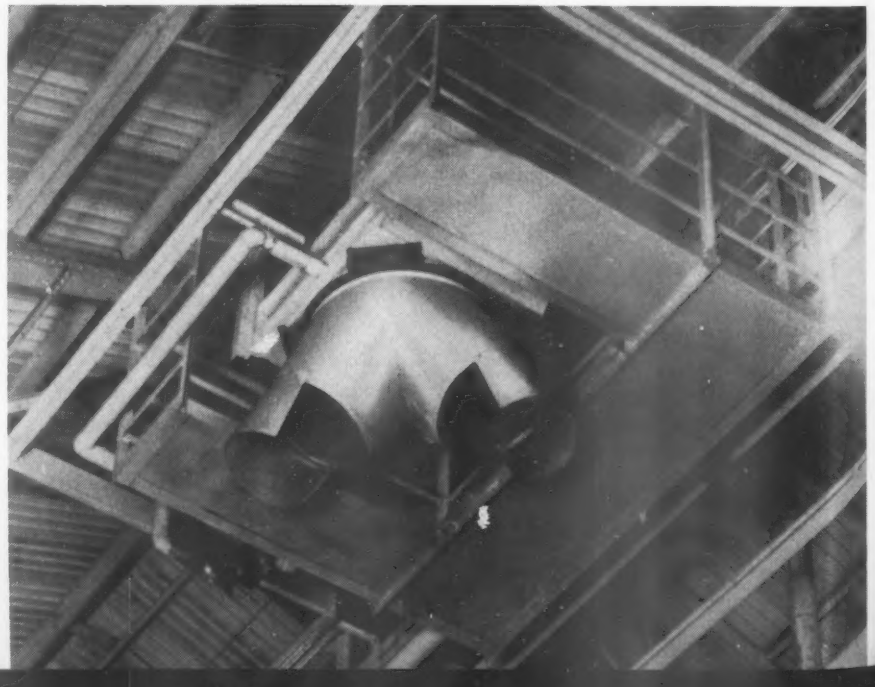
These buildings total 850,000 sq. ft. of floor area. A more significant figure in regard to heating and ventilating is their total volume, which is nearly 55,000,000 cubic feet. This latter volume of air is changed every hour, winter and summer. The inside winter temperature is automatically maintained between 60° and 70° F.

Make-up Air

The system design did not merely provide for the intake, heating, and distribution of air uniformly throughout the buildings. It had to also take into account such factors as fume exhaust systems, inrush of air through open doors, heat generated by machinery, and the need for special air cooling in certain locations.

In Fig. No. 5, Building No. 1 is a special case, since the steel coils as received are normally warm, having come directly from the hot mill. Because of this and because no employees have fixed work stations in this building, no direct heating nor fresh air supply units

Fig. 3: *Below, typical heater installation. Note access platform, revolving discharge, mounting in truss area.*



were installed. The heat from the coils as well as from the adjacent pickle building maintains a comfortable temperature within this building during cold weather.

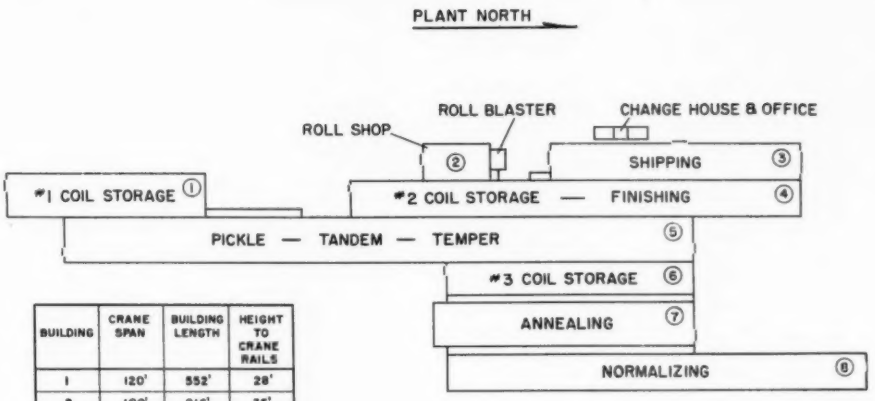
During warm periods, louvers along outside walls together with gravity and power roof vents maintain adequate ventilation. An automatic door heater is installed over the track and truck entrance located on the south end of the building. When vehicles pass in or out the overhead heater tempers the inrushing cold air.

In Building 7 the annealing furnaces generate heat. Air is brought into the basement to cool the coils and is delivered onto the floor above. Therefore, the main part of this building does not require additional heaters or a separate fresh air supply. A fresh air supply heater, however, is located at the south end of the building directly over the atmospheric gas generators, and a truck dock at the north end has a door heater.

The normalizing, pickling lines and the tandem mill have exhaust systems for fume removal. With the special exceptions just noted, the system of heaters and roof vents takes care of the entire job of heating and changing 55,000,000 cubic air per hour.

Location Of Units

Fig. No. 6 shows location of the heater units. Solid squares are door heaters; blank circles fresh air supply heaters, and solid circles are recirculating heaters. Triangles represent condensate—utilizing recirculating heaters. The totals are 37 fresh air supply heaters, 25 recirculating heaters, and 15 door heaters. Also part of the system are a total of 76 gravity roof ventilators, 21 power roof ventilators, and above the annealing department, 2 continuous ridge type roof ventilators.



BUILDING	CRANE SPAN	BUILDING LENGTH	HEIGHT TO CRANE RAILS
1	120'	552'	28'
2	100'	216'	35'
3	100'	696'	28'
4	100'	1272'	28'
5	120'	1824'	36'
6	100'	696'	36'
7	120'	744'	47'
8	100'	1224'	28'

GENERAL LAYOUT OF BUILDINGS

Fig. 4: *Steel mill layout of eight buildings discussed in this article. Office and change house are shown but are not considered in this article.*

Fig. No. 7 shows one of the fresh air supply units from the catwalk. These units have a rated capacity of 25,000 cfm except for one in the roll blast lean-to which is rated at 12,000 cfm. They heat air to a maximum of 110°F even with outside air as low as minus 10°F. Except under remotely possible recirculation operation, they bring in their full capacity of fresh air continuously, summer or winter, heating whatever proportion of it is necessary to maintain 70° at the floor level to satisfy the settings of the thermostats. The short ducting to the roof is visible.

Recirculating heaters handle 25,000 cfm. Each has a rated output of 1,600,000 Btu with air entering at 70°F. They operate on steam at 100 psi and 400°F.

There are eight additional recirculating heaters, one in each zone, which operate on condensate at approximately 338°F as received from the other units in the zone. It appears almost identical to the standard recirculating heaters, the only difference being a double-deck heater section instead of a single row of steam coils. This increases the capacity to 2,030,000 Btu despite the lower heat content in the condensate fed to it. These heaters save a large amount of heat from the 338° condensate. They use this heat and finally discharge the water at approximately 215°F. All recirculating heater fan motors operate only when their thermostats call for heat. Thus they run "on-and-off" to assist in stabilizing floor temperatures at 70°.

Typical Door Heater

Fig. No. 8 illustrates a typical door heater installation. These particular units are installed above truck doors at one end of the shipping building. The door heaters are each rated at 25,000 cfm and 1,600,000 Btu per hour. In cold weather, limit switches turn the fan motors on when doors start to open, and off when the doors close. They also have overriding room thermostats which turn them on, whether the door is open or not, if the temperature in the vicinity is below thermostat setting.

Door heaters are designed to produce a velocity of approximately 1850 feet per minute to insure the downward curtain of air pene-

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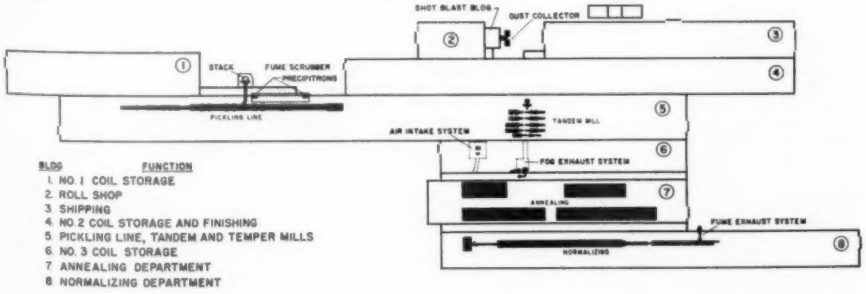
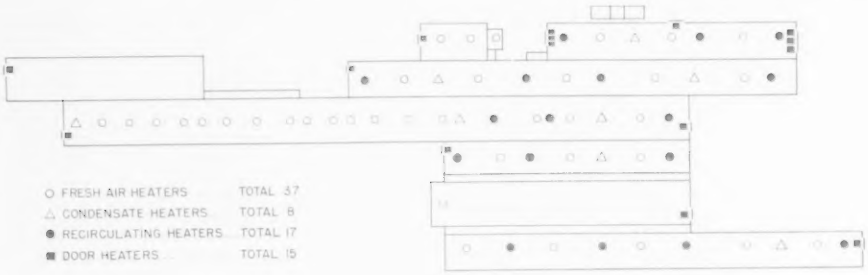
Fig. 5: *In building No. 1 steel coils are received warm from hot mill. Heat from these coils and from adjacent pickle building maintains comfort temperature in this building during cold weather.*



SOURCES OF HEAT, AIR SUPPLY, FUME REMOVAL, APART FROM HEATING AND VENTILATING SYSTEM



LOCATION OF HEATING AND FRESH AIR SUPPLY EQUIPMENT

Fig. 6: *Location of unit heaters. Solid squares are door heaters; blank circles, fresh air heaters; solid circles recirculating heaters. Triangles are condensate-using heaters.*

(Continued from preceding page)

trating the incoming cold air and reaching the floor. The curtain is not intended to prevent entry of outside air, but to temper it and prevent cold blasts.

Fig. No. 9 gives a cross section of the fresh air supply units as installed. These take in fresh air at widely varying temperatures and discharge it at varying controlled outlet temperatures. To achieve this, their heating sections consist of a number of alternate air heating passages and bypasses. Air passing through the openings marked "A" passes over the heating coils. Air passing through the openings marked "B" bypasses the heating coils. Each individual passage is provided with a volume control damper. All "A" dampers are linked together as are all "B" dampers, and each set is actuated by its own thermostatically-controlled modulating damper motor.

Damper Control

Air must pass through the unit regardless of the demand for heat. Therefore, as one set of dampers moves one way or the other, the second set moves oppositely an equivalent amount. The amount of steam used varies directly with the need for heat at the floor level. This is determined by a modulating thermostat, which positions the dampers to vary the proportion of air going over the heating coils rather than through the bypass openings. In minus 10° weather all the air passes over the coils. In summer all of it goes through the bypasses. In between these extremes, when some heat is required, a varying proportion passes through each set of openings.

This unique design was adopted for several reasons. For instance during the heating season a full head of steam is always carried on the coils. This eliminates their being subjected to condensate freeze-up as would be the case if the steam supply were modulated. Moreover, by keeping the coils heated the air is uniformly heated across their face, thus avoiding stratification as would likely happen if there were a temperature gradient resulting from modulation of the steam.

Note the damper in the fresh air supply duct connected to the roof. This damper is power-operated from a 3-way floor switch which also simultaneously operates the dampers on the side of the roof duct. If the switch is thrown to one position, the fresh air roof inlet damper will close and the recirculating damper will open, thus causing the heater to operate on recirculation. This procedure could be followed in an emergency should the steam supply be cut off or curtailed and thereby be unable to supply sufficient Btu to heat 55,000,000 cubic feet of air per hour coming in at a low temperature.

Door Heater Control

Except for the door limit switches in connection with the door heaters, the controls of door heaters and recirculation heaters are identical and are of room "on-off" type thermostats.

The system of controls employed is important in order to obtain comfortably close temperature regulation, plus an adequate supply of fresh air for ventilation. The problem is complicated because different buildings or heating zones are open to each other and thereby influence, without control, the temperatures in their neighboring zones. In other words, each zone control regulates the heat flow from its own heaters but not directly the heat gain or loss from adjacent zones.

In summer, the recirculating heaters are operated without steam to promote air circulation. In winter, they have only one major

Fig. 7: *Fresh air supply heaters shown from catwalk. These units can be used for winter heating, summer ventilation.*

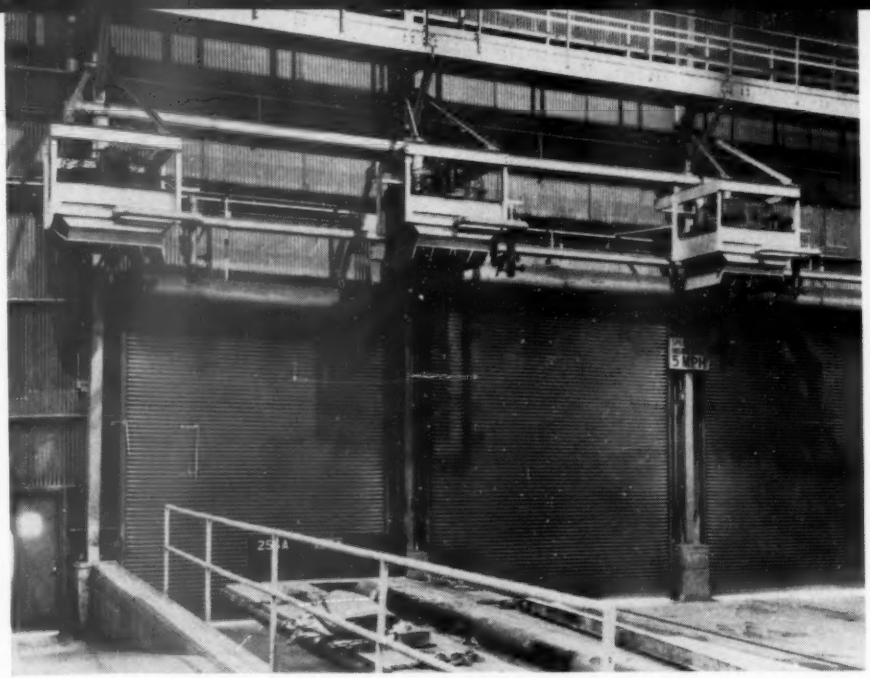


Fig. 8: *Typical door heater installation. Units are installed above truck doors at one end of shipping building. In cold weather, fan motors are turned on when doors start to open, closed when doors close. Overriding thermostats also maintain comfort conditions as needed.*

function—to help make up heat loss. Thus, their control is simple, consisting only of an "on-or-off" room-type thermostat. However, the fresh air supply units require additional control since they must both bring in ventilating air regardless of the need for heat, and provide heat as conditions at the floor may require.

A modulating thermostat located on a steel building column 8 ft. above the floor level, is set at 70°F. This instrument modulates the face and bypass dampers built in the heater coil. Thus as the outside temperature varies, so will vary the proportion of air going through the hot coils or bypasses. In this manner, heat is added to the air only as required to maintain the desired floor level temperature.

An airstream modulating thermostat, used as a limit switch, operates in conjunction with the modulating thermostat to insure the air leaving the coils does not exceed 110°F. This is the temperature found desirable on this job to insure heat reaching the floor. In other installations this temperature could be different.

When the floor thermostat is satisfied and the face dampers largely or fully closed, the incoming fresh air would likely cause the discharge temperature to drop. If the latter should drop too low, the modulating thermostat No. 3 would reposition the face and bypass dampers to maintain minimum discharge temperature.

As a safety feature, in case of steam failure when the inlet air temperature is below 40°F, thermostat 4, an "on-off" type, stops the fan motor and closes the fresh air inlet dampers. This motor stoppage would occur whether the operation is on fresh air supply or recirculation.

A fifth thermostat, an "on-off" type set to provide 73°, starts and stops the fan motors when the heaters operate on recirculation. Its sensing element is located on the column 8 ft. above floor level.

On a panel board at floor level is a manual 3-way switch enabling the foreman to operate the fresh air supply heaters on fresh air supply, recirculation, or shut them off.

When this latter switch is on recirculation, the fresh air inlet dampers close and the recirculation dampers open automatically. The opposite occurs when the switch is turned to fresh air supply.

Please bear in mind that the actual temperatures mentioned apply only to this mill and this

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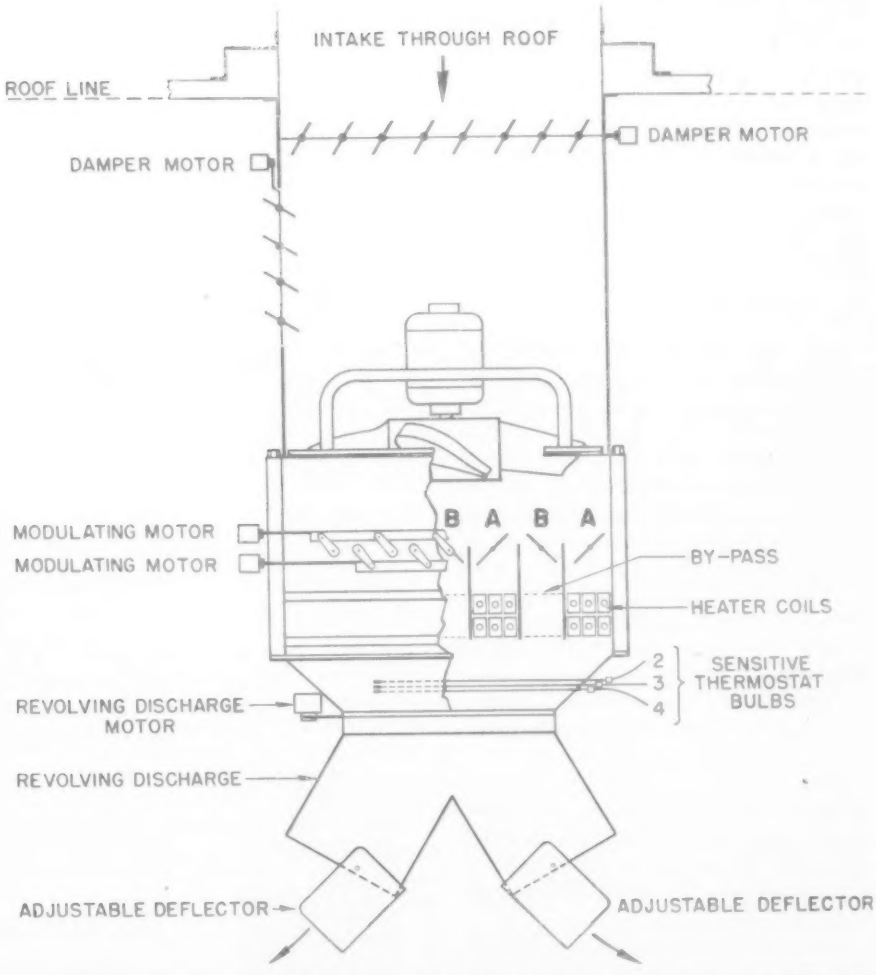


CROSS-SECTION OF FRESH AIR SUPPLY HEATER

Fig. 9: *Cross section of outside air supply units as installed. See text in column one, page 28, for complete description of how these units are controlled.*

Fig. 10: *Recording thermometer is mounted on a column near tandem mill. Readings are recorded daily during severe weather.*

(Continued from preceding page)

particular heater design and could vary somewhat to satisfy the comfort requirements of another mill where the conditions are different.

During the early startup of the system, and before the controls were adjusted, the temperatures varied considerably from point to point in the mill. Helping to cause these wide variations was the uncontrolled heat flow from the buildings open to each other. For these reasons, and because of the need to experience a variety of weathers before the system was "shaken down," final thermostat settings were not completed until well into the first winter of operation. During a representative period of the second winter, with no new adjustment of thermostat settings, regular temperature readings were taken in and outside the plant.

Recorded Data

Fig. No. 10 shows a recording thermometer mounted on a column near the tandem mill. A similar thermometer was located outside on the north wall of the building in which the tandem mill is located. Three other thermometers, not of the recording type, were located at the shear line, in the roll shop, and at the pickle line. The readings were recorded daily during the severe weather experienced late this past winter. During this period, outside temperatures varied between 15° and 45°F above zero.

Fig. No. 11 shows a pair of typical charts, one inside and one outside, taken simultaneously. The functioning of the controls is indicated by the smoother inside curve regardless of the wide variations outside.

Of great importance is the fact that at no given time during the period when temperatures were recorded was there more than a 6 degree difference between widely separated points in the mill. If the somewhat special case of the isolated roll shop is eliminated, the difference would be but 3 degrees. Thus an employee encounters no chill or overheating in walking from one location to another, anywhere in the mill.

Additional refinements in individual thermostat settings could be made to further reduce the spread of inside temperatures, but this has not been considered necessary since the present range is comfortable.

In the two seasons during which the system has been operating, the heaters have required no major maintenance or repairs. No major maintenance is anticipated in the forseeable future except normal lubrication.

Here are a few final points on the advantages of the system:

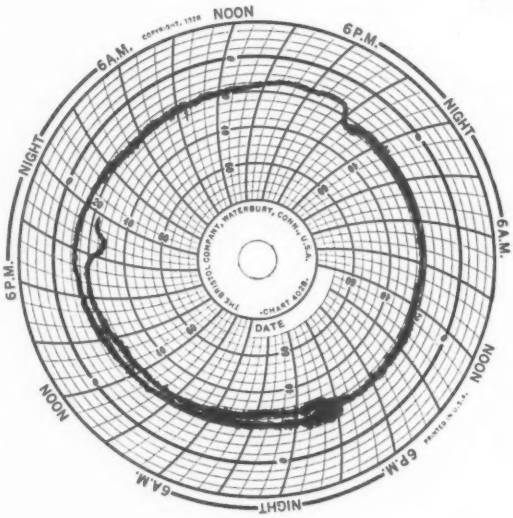
1. Due to a slight pressurization of the mill building from the injection by the heaters of the large volume of heated fresh air, there are few cold drafts or cold spots which cause human discomfort.

2. The gentle air movement from the revolving heater discharges adds to human comfort and carries away or evaporates normal perspiration from the body, whereas quiescent, inactive air tends to be stuffy and humid.

3. Fresh outside air is constantly being pumped into the mill for ventilation purposes.

4. The widespread and uniform distribution of heat prevents condensation on cold walls and other building members by not allowing the temperature in any part of the mill to drop below the dew point. Condensation otherwise could cause much corrosion on both structure and steel products.

5. The same heating equipment is operated in the summer time, with steam turned off, to produce a slight air motion at the floor level. ▲▲



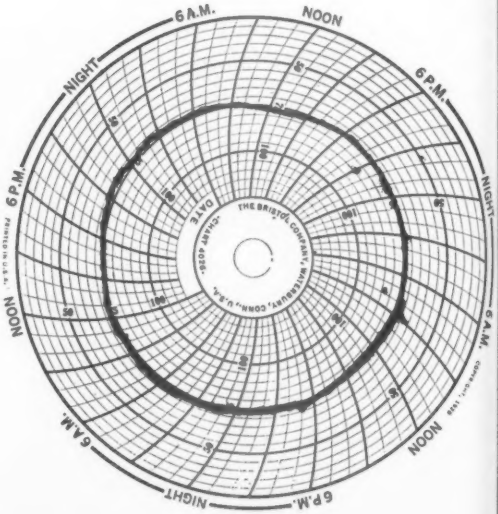
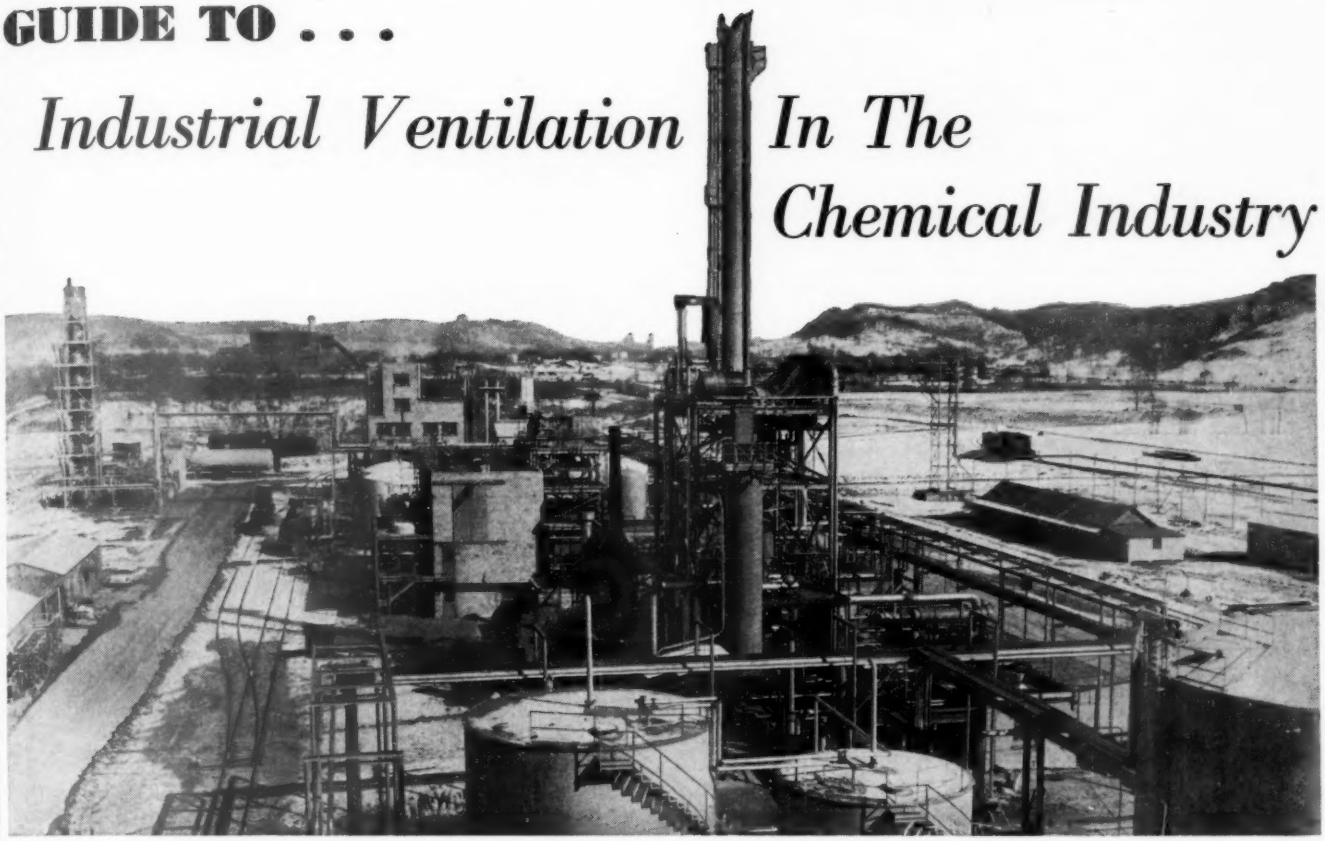


Fig. 11: *Typical charts from recorders (Fig. 10). Top chart, of outside temperature, was recorded at same time bottom chart of inside temperatures. At no time during period when temperatures were recorded was there a six degree variation throughout the mill.*

GUIDE TO . . .

Industrial Ventilation In The Chemical Industry



View of American Cyanamid Co.'s new aniline manufacturing facilities at Willow Island, W. Va. Plants such as these require careful design of ventilating systems to maintain employee health.

By William V. Andresen
Chief Industrial Hygienist
American Cyanamid Co.

Sources and exposures on gases, mists and vapors from plate and filter press equipment. Design data on needed ventilation for fume control.

A PREVIOUS ARTICLE discussed the general principles of filtration in the chemical industry and described ventilation techniques for batch and continuous vacuum filters. Two general types of pressure filters are utilized in the chemical industry, open, or plate and frame filter presses, and enclosed pressure filters.

This article discusses the avenues of exposure of personnel to gases, mists and vapors evolved during plate and frame filter press operation and outlines a number of ventilation techniques which have been used successfully for control of these evolutions.

Plate and frame filter presses are batch or intermittent in operation. They consist of alternate vertical frames and plates suspended on side rails and pressed tightly together during filtration. The plates, whose surfaces are grooved, are covered with filter cloth. The liquid solid mixture to be filtered is pumped into the hollow frames and the liquid filters through the cloth on the plates and is drained by the grooves to a removal point.

Filter presses can be purchased in sizes with plates and frames ranging from approximately six inches square to six feet or more.

Open And Closed Delivery

There are two different methods of draining the filtrate from the press. These are known as open delivery and closed delivery. In an open delivery press each press plate is equipped with an individual spigot and the filtrate drains into an open trough. In a closed delivery filter press, the filtrate drains through holes in the plates and frames, into a common closed discharge line.

Operators engaged in filter press operations may

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***WILLIAM ANDRESEN** is chief industrial hygienist for the American Cyanamid Co. A graduate engineer, he is vice chairman of the Bergen County, New Jersey air pollution control committee. He is also a delegate from the National Safety Council to the American Standards Association committee Z-9 on industrial ventilation. He is a member of the American Industrial Hygiene Association.*

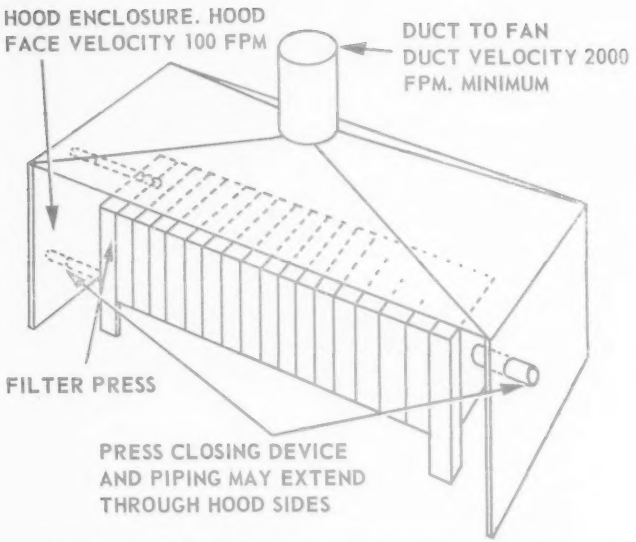
HOOD ENCLOSURE. HOOD FACE VELOCITY 100 FPM
DUCT TO FAN DUCT VELOCITY 2000 FPM. MINIMUM
FILTER PRESS
PRESS CLOSING DEVICE AND PIPING MAY EXTEND THROUGH HOOD SIDES
HOOD ENCLOSURE FOR FILTER PRESSED UP TO 24" SQUARE. FILTER PRESS ENCLOSED WITHIN HOOD. ALL FILTER PRESS OPERATIONS PERFORMED BY ONE OPERATOR WITHIN HOOD. CURTAIN MAY BE INSTALLED ACROSS HOOD FACE.

Fig. 1: *Control of gas, mist and vapor evolution from frame and plate filter operations can be achieved with booth type enclosure shown above.*

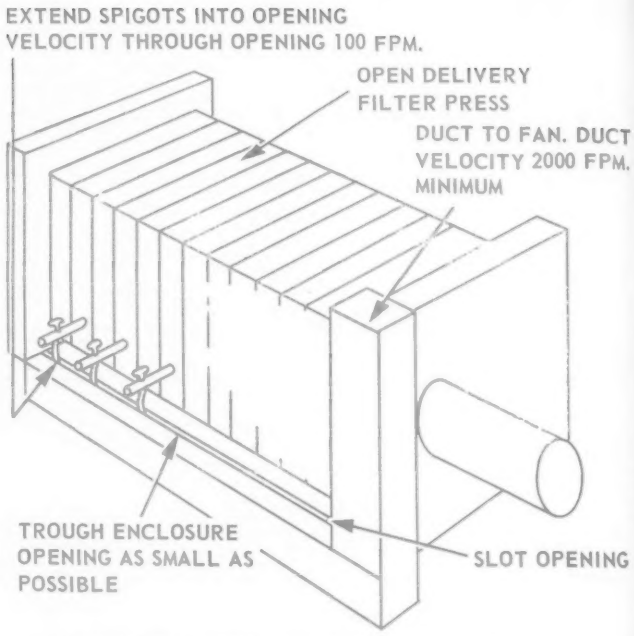
EXTEND SPIGOTS INTO OPENING
VELOCITY THROUGH OPENING 100 FPM.
OPEN DELIVERY FILTER PRESS
DUCT TO FAN. DUCT VELOCITY 2000 FPM. MINIMUM
TROUGH ENCLOSURE OPENING AS SMALL AS POSSIBLE
SLOT OPENING
MECHANICAL EXHAUST VENTILATION FOR CONTROL OF GASES OR VAPORS LIBERATED FROM TROUGH DURING OPEN DELIVERY FILTER PRESS OPERATIONS.

Fig. 2: *In open delivery filter press operation, toxic material may occur only during filtration. Control of gases, mists and vapors can be obtained by covering the trough as shown above and using mechanical exhaust ventilation.*

(Continued from preceding page)

be exposed to gases, vapors and mists liberated during press filling and washing, press emptying and press cleaning and setting up, or a combination of these operations.

Plate and frame filter press 24 inches square or less can usually be emptied, cleaned and set up by one operator. Control of gas, mist and vapor evolution from these operations can be realized by the use of a booth type enclosure as is shown in Fig. 1. A velocity of 100 fpm should be maintained across the working opening for satisfactory control. If evolution of gases, mists and vapor occur only during filtration, a curtain may be installed in front of the opening and only sufficient air exhausted to maintain an indraft on the enclosure.

Open Delivery Filter Press

In open delivery filter press operation, evolution of toxic material may occur only during filtration and be liberated from the trough into which the spigots on the plates drain. Satisfactory control of gases, mists and vapors can be realized by covering the trough as shown in Fig. 2 and applying mechanical exhaust ventilation to draw air through the opening on the trough cover. Satisfactory control can usually be realized by a velocity of 100 fpm through the slot. In hot filtration, natural draft may provide effective control.

Fig. 3 shows a portable hood which may be used to control gases and vapors liberated from the trough during open delivery press operations. The hood is installed during filtration but is removed when the press is cleaned and set up. A face velocity of 100 fpm will usually provide satisfactory control.

Operations with large open or closed delivery presses, in which evolution of gases or mists occur

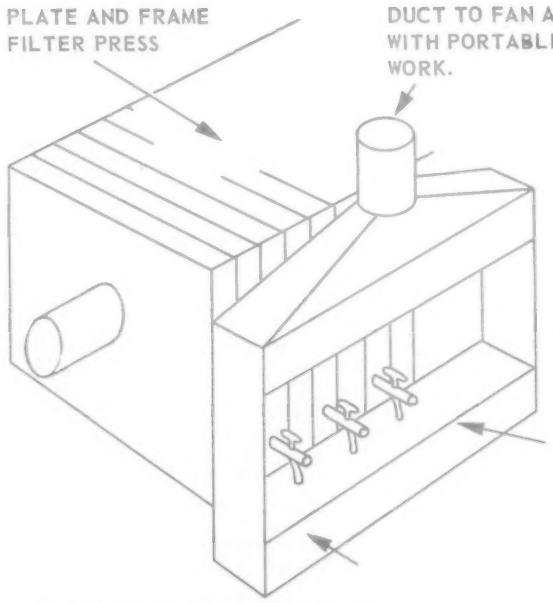
PLATE AND FRAME FILTER PRESS
DUCT TO FAN ATTACH WITH PORTABLE DUCTWORK.
PORTABLE HOOD ENCLOSURE TO CONTROL GASES AND VAPORS LIBERATED FROM TROUGH OF AN OPEN DELIVERY FILTER PRESS. ATTACH TO EXHAUST SYSTEM WITH FLEXIBLE DUCTWORK.

Fig. 3: *Portable hood for controlling gases and vapors from trough during open delivery press operations.*

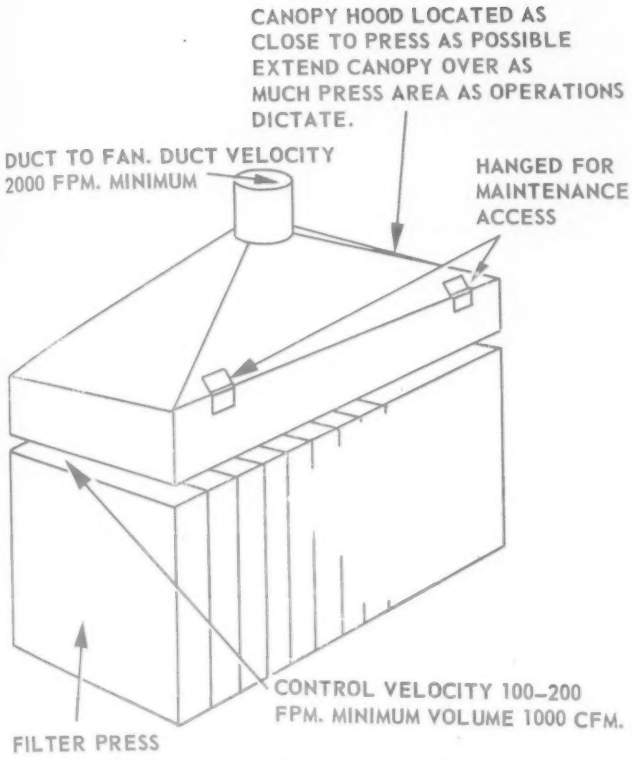
CANOPY HOOD LOCATED AS CLOSE TO PRESS AS POSSIBLE EXTEND CANOPY OVER AS MUCH PRESS AREA AS OPERATIONS DICTATE.
DUCT TO FAN. DUCT VELOCITY 2000 FPM. MINIMUM
HANGED FOR MAINTENANCE ACCESS
CONTROL VELOCITY 100–200 FPM. MINIMUM VOLUME 1000 CFM.
FILTER PRESS
CANOPY TYPE HOOD FOR CONTROL OF GAS VAPORS LIBERATED DURING FILTER PRESS CLEANING AND SETTING-UP OPERATIONS. A CONTROL VELOCITY OF 100 FPM THROUGH OPENING WILL USUALLY PROVIDE CONTROL. A MINIMUM VOLUME OF 1000 CFM SHOULD BE USED.

Fig. 4: *Canopy hood for solvent control during press cleaning and setting up.*

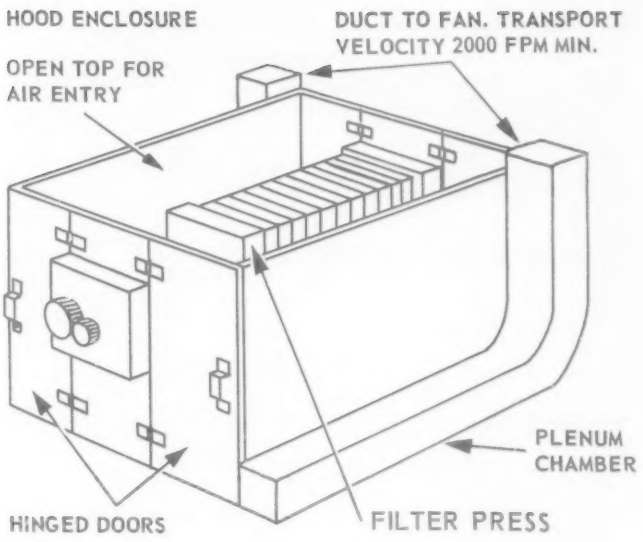
HOOD ENCLOSURE
DUCT TO FAN. TRANSPORT VELOCITY 2000 FPM MIN.
OPEN TOP FOR AIR ENTRY
PLENUM CHAMBER
HINGED DOORS
FILTER PRESS
OPEN TOP DOWNDRAFT ENCLOSURE FOR THE CONTROL OF VAPORS DURING FILTER PRESS OPERATION. CONTROL AIR AT A MINIMUM OF 100 FPM. IS DRAWN THROUGH TOP. TOP MAY BE CLOSED AND AIR DRAWN THROUGH UPPER SIDES OPERATOR CLEANS AND SETS UP PRESS INSIDE OF ENCLOSURE.

Fig. 5: ***Hood enclosure with down draft ventilation for control of gases and vapor during filter press operation.***

only during filtration, may be controlled by hood enclosure with curtain sides similar to Fig. 1. A small air volume sufficient to maintain an indraft of the enclosure will provide satisfactory control. The curtain sides are closed during filtration and open during press cleaning and setting-up operations.

If employee exposure occurs during press cleaning and setting up, as in cleaning presses used for polishing synthetic resins containing solvent or filtrations where volatile solvents remain in the filter cake, the ventilation must be designed to provide control during these operations.

Canopy Hood Design

Fig. 4 shows a canopy hood design which has been used successfully for solvent control during press cleaning and setting up. The canopy hood is located as close to the press top as feasible and extends over the press as far as possible without interfering in the press operations. An air volume which will result in an air velocity of approximately 100-200 fpm at the edges of the press should be utilized. A minimum air volume of 1000 cfm should be used.

Down draft ventilation in conjunction with hood enclose has been used to control airborne contaminants during filter press cleaning and setting up.

Fig. 5 shows a hood enclosure with down draft ventilation for control of gases and vapor during filter press operation. The operator works inside of the enclosure. The sketch shows the hood top open. The top may be closed if desired and opening the upper portion of sides provided instead. A control volume of 100 fpm across the openings should provide satisfactory control. Openings in sides should approximate the open top area.

The base of the filter press may be enclosed within a curbed area to contain drippings and filtered product with toxic or irritating solvents within the ventilated area. Additional ventilation may be required for the container into which the filtered product is transferred. Ventilation for drums, etc. has been described in previous articles. ▲▲

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In Orange County, California . . .

Mobile Air Sampling Station Tracks Smog

When a stationary air pollution checking station can't reach out far enough to measure increased air pollution, a portable lab may be the answer.

Reading a field report in front of Orange County's (Calif.) mobile air monitoring station are Air Pollution Control District officials (from left): Al Cuba, instrument technician; William Petersen, senior instrument technician; and William Fitchen, APC officer.

ORANGE COUNTY HAS a problem familiar to many other parts of the country: it doesn't have much smog now, but that doesn't mean that someday the situation couldn't be worse.

Geographically, the county borders on Los Angeles, Riverside and San Bernardino Counties and the Pacific Ocean. It is primarily an agricultural center, mainly of citrus and truck crops.

However, in recent years, the county has trebled in population and industry has spread into every corner of it. And although most of the industrial newcomers are in the electronics, missiles and other "clean" fields, their arrivals have sparked a pertinent awareness by county officials of the air pollution problem.

The county in the past has relied on three permanent sampling stations for its air pollution information. Located in the strategic centers of Anaheim, Santa Ana Canyon and Newport Beach, readings from these installations covered most of the county's heavily concentrated areas of industry and population.

It has since, however, become evident the county had outgrown the protective ring of the three permanent stations, and that there was the distinct possibility of dangerous air pollution sources developing undetected.

To meet the rising challenge of a large area to cover, and a limited budget to do it with, the county put into service a mobile air monitoring station, probably the most refined of its kind in use today.

Designed and built to county needs by Beckman Instruments, Inc., of Fullerton, Calif., it offers the double-barreled service of providing a fourth complete sampling station, plus vital mobility.

The station, which was built under a $48,000 contract, fits concisely into a 1959, step-van paneled truck. Its six Beckman instruments to identify and measure individual pollution constituents, plus other lab equipment, are identical to the equipment in the county's permanent stations.

The county is using the station to help establish air pollution trends in previously uncharted areas, an invaluable aid to its long-range industrial zoning programs.

The laboratory on wheels is parked in selected areas and left for day-long periods without an operator for, once set, its instruments operate automatically with their readings being continuously recorded.

During its first year of service, the station will be used in selected areas to chart air pollution trends for periods of one to three months. The following year, it will be returned to the same places for the same lengths of time, thereby establishing definite air pollution trends.

By so doing, the county hopes to eliminate any potential air pollution trouble spots before they reach the danger stage.

Air is pumped into the unit's instruments through a collapsible, specially treated polyethelene antenna that extends 20 ft. into the air. Two infrared instruments measure the percentages of hydrocarbons and carbon monoxide, while four other air pollution analyzers test for oxidants, nitric oxide, nitrogen dioxide and sulphur dioxide.

The sample handling system is divided into two main sub-systems. The first sub-system is operated under pressure from two pumps. It delivers the sample to the two infrared analyzers and also pres-

(Please turn to page 43)

Automatic Techniques of Airborne Particle Counting

Part II

Here's a special report from Armour Research Foundation on airborne particle size and concentration in white room areas, as recorded by automatic particle counter.

TABLE II SHOWS the effect of various operations and activities on the particle content of the cleaning area. When clean and free of activity the area contains less than 100 particles larger than 0.5-micron diameter per liter of air. The total count, while important, is not as informative as the size distribution data. When there was no activity in the area, the particles were mostly submicron in size and no particles above 4 microns were present. Similar size distributions were found in the other areas when they were free of activity.

The random movements of one person increased the particle count and introduced particles with diameters of 4-8 microns. When the worker opened the air lock for the short period of time necessary to admit parts, the size distribution was not significantly altered. More small particles were found, but particles larger than those already present were not introduced. It is concluded that the static pressure differential between the air lock and the general plant area was sufficient to prevent particles from entering the air lock during the test period.

The activity of two people, one repackaging parts and the other flushing the compressed air lines into the vacuum lines, again broadened the size distribution. Particles up to 16 microns in diameter were produced.

Starting a trichloroethylene sonic degreaser for the first time caused the particle concentration to increase to 490 particles/liter. Almost 50 particles/liter were above 4 microns in size. After 1½ hr. of degreaser operation, the initial "burst" of material disappeared and the concentration and size distribution fell to the level expected with two people in the area. No parts were cleaned during this and subsequent degreaser operations.

Five persons working in the area caused the particle count to rise to 183 and produced particles up to 32 microns in diameter. The ability of the area to recover from this peak activity is shown in Table III. At 11:10 a.m. with five people in the area, the total particle concentration was 167 particles/liter including particles up to 16 microns in diameter. The five people left for lunch at random times between 11:10 and 11:50 a.m. when all were gone. The total concentration at 11:50 was 112 particles/liter, with no particles above 2 microns present.

After lunch six people returned to the area, and the average concentration throughout the afternoon was 314 particles/liter. Although this concentration was about twice that found in the morning, the increase was mainly due to particles below 2 microns in size.

At the change of shift, five people left the area and one person stayed to tidy up. The concentra-

(Please turn to following page)

by **A. Lieberman and J. Stockham**, ***Research Engineers, Armour Research Foundation, Chicago***

(Continued from preceding page)

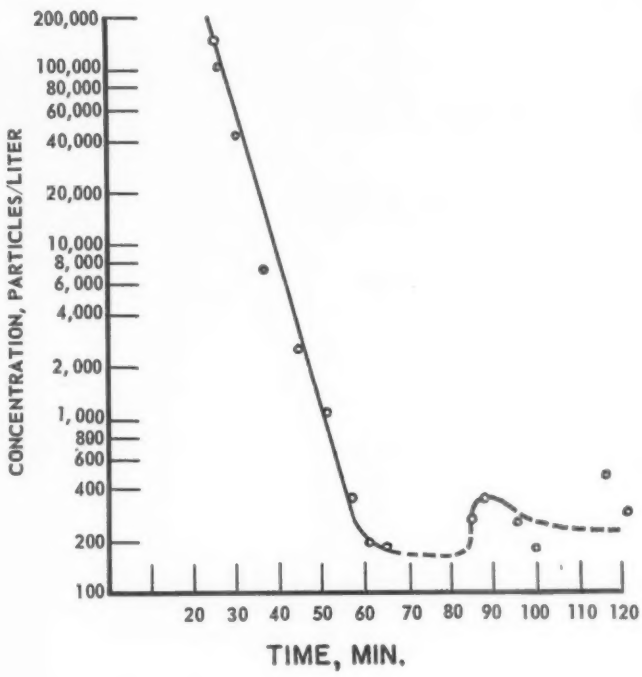
tion of particles dropped at once and the size distribution was similar to that found previously with one person in the area.

Table IV presents data obtained during a leak test in the assembly area. The test was run to locate sources of air leakage in order to reduce the volume of makeup air. The exit registers were closed and two smoke candles were ignited. After the return air vents were reopened the particle concentration was observed. The data are plotted in Fig. 2.

The particles produced by the smoke bombs were 8 microns and under in diameter. Before the exit registers were opened (time -11 to time 0), the particle concentration at the sampling point varied with random air currents in the room. When the exit registers were opened (time 0), the particle concentration began to increase rapidly until time 7, when it was assumed that the smoke was uniformly dispersed throughout the room. After time 7, the concentration fell rapidly until time 27.

During this period the concentration of particles below 1 micron in diameter was too high to use the small size range of the particle counter. At time 27, the aerosol was diluted sufficiently to obtain particle sizes in the 0.5-0.7 micron range. About 1 hour after the exit registers were opened the particle content and size distribution approached the no-activity level.

The effect of activity in the room was amply demonstrated at time 89. At this time one man entered the room to pick up some tacky slides and impactor samples



taken during the test. Although the small-particle concentration continued to decrease, the number of large particles immediately increased. About 20 min. were required to remove the large particles.

Summary and Conclusions

An automatic particle counter was used to examine the atmosphere in a newly completed ultraclean room. At the time of the test the room was not being used routinely, but simulated operations were performed to study their effects on the particle count.

At zero activity, the particle concentration in the room varied near 100 particles/liter of air. This concentration included submicron particles almost exclusively. The concentration of particles larger than 1 micron was approximately 10/liter. No particles larger than 4 microns in diameter were found. These values can be compared with those found in dust-free hoods of the type in general use, which usually emit no particles larger than 1.5 microns.

The zero-activity, background concentration varied from day to day. These variations are probably a result of minor changes in room cleaning procedures, in atmospheric conditions, particularly relative humidity, and in air cleaning and flow. In addition to the day-to-day changes in particulate concentration, there were small (about 10 percent) variations in concentration from minute to minute. No explanation is offered

Table II. Effect of Various Operations and Activities on the Particle Content in the Cleaning Area

Operation or Activity	Number of People In Area	Concentration, particles/liter 0.5-1 micron	1-2 microns	2-4 microns	4-8 microns	8-16 microns	16-32 microns	Total
None	0	86	7	2	0	0	0	95
Random movement	1	32*	47	27	6			112
Opening air lock to admit parts	1	59*	61	34	6	0	0	160
Repackaging parts and flushing air lines	2	85	20	13	6	3	0	127
Repackaging parts and starting sonic degreaser	2	185	144	112	38	11	0	490
Repackaging parts and operating sonic degreaser for 1½ hr	2	110	24	11	3	0	0	148
Repackaging and inspecting parts and operating sonic degreaser	5	101	37	26	13	5	1	183
Repackaging and inspecting parts and operating sonic degreaser	6	191	70	37	15	1	0	314
Tidying up after above activity	1	45	19	13	6	0	0	83

*0.7-1.4 microns.

for these variations, except to comment that such variations are observed in normal air parcels.

The static pressure differential of 0.2 in. of water between the cleaning area and the general plant was sufficient to prevent contamination of the area during the time required to introduce parts through the air lock.

Increasing activity in the room was accompanied by a corresponding increase in large-particle concentration. The increase in the number of small particles was normal and similar to that in the area at rest. The increase in large particles 5-32 microns in diameter is important. These particles show up as individual events which do not appreciably affect the over-all concentration. However, they present serious hazards to the performance of items being assembled in the area.

The large particles come from operation of the trichloroethylene degreaser, from lint, and from abrasion products of skin, clothing, and parts. Previous experience has shown that abrasion products of skin are usually not larger than 5 microns in diameter, and the airborne products of parts abrasion should not be over 10 microns. Therefore, the other sources listed are probably chiefly responsible for the particles up to 32 microns. The effect of personnel and activity on the presence of large particles was not evaluated quantitatively.

The burst of particles observed when the degreaser was first placed in operation indicates that caution is required whenever new equipment or techniques are used in an ultraclean room. A sampling tube extension could be used to monitor the air immediately surrounding a specific new piece of equipment or a new operation. Subsequent operation of the degreaser was not as deleterious.

The recovery time of the room from simulated normal operations was about 20 minutes, and from the extreme contamination produced by smoke candles, about 1 hour. Recovery time is a function of the number of air changes and of room size. Each air change removes a fairly constant percentage of the material present in the air until the concentration is that normally present. Therefore, if the air change rate is increased, the recovery time would decrease.

The work described above was performed under the sponsorship of the Baker Company, Incorporated, of Biddeford, Maine.

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2. Avery, R., *Air Engineering, 1,* 29, April, 1959.
3. Katz, S., Fisher, M. A., and Lieberman, A., *Proc. 42nd Midyear Meeting Chemical Specialties Manufacturing Assoc.,* May 21-22, 1956, Chicago, Ill., p. 50.

Table III. Recovery of the Cleaning Area During the Lunch Period

Time	Concentration, particles/liter 0.5-1 micron	1-2 microns	2-4 microns	4-8 microns	8-16 microns	16-32 microns	Total
11:10 a.m.	94	28	28	11	6	0	167
11:17 a.m.	115	16	6	11	0	0	148
11:35 a.m.	83	22	6	6	0	0	117
11:50 a.m.	99	13	0	0	0	0	112

Table IV. Decrease of the Particle Content with Time at the South Sampling Point in the Precision Assembly Area after the Smoke Bomb had been Set Off

Time,* min	Concentration, particles/liter 0.5-0.7 micron	0.7-1.0 micron	1.0-1.4 microns	1.4-2.0 microns	2.0-2.8 microns	2.8-4.0 microns	4.0-5.6 microns	5.6-8 microns	8-16 microns	16-32 microns	32-64 microns	Total
–9	..	..	3,430		396		42		0	0	0	..
–7	..	..	9,960		2,230		42		0	0	0	..
–5	..	..	15,170		3,280		42		0	0	0	..
–3	..	..	15,590		4,530		42		0	0	0	..
–1	..	..	17,890		3,430		42		0	0	0	..
0	..	..	31,890		14,350		42		0	0	0	..
3	..	..	39,250		21,130		125		0	0	0	..
7	..	..	82,890		99,450		0		0	0	0	..
13	..	..		43,650	4,015	627	0	0	0	..	..	..
15	..	..		26,030	3,260	125	125	0	0	..	..	..
20	..	..		520	63	0	0	0	0	..	..	..
21	..	..	4,950	502	63	0	0	0	..	..	..	..
27	93,500	50,700	5,600	502	0	0	..	..	..	..	..	150,302
28	64,600	30,900	8,151	314	0	0	..	..	..	..	..	103,965
32	30,000	13,700	1,133	63	0	0	..	..	..	..	..	44,896
37	4,140	960	21	6	0	0	..	..	..	..	..	5,127
47	2,013	458	84	11	0	0	..	..	..	..	..	2,566
52	862	153	15	0	0	0	..	..	..	..	..	1,030
58	310	32	6	0	0	0	..	..	..	..	..	348
61	163	21	6	0	0	0	..	..	..	..	..	190
64	168	15	0	0	0	0	..	..	..	..	..	183
87	242	21	6	6	0	0	..	..	..	..	..	275
89**	210	26	36	21	36	15	..	..	..	..	..	344
97	132	21	32	32	21	6	..	..	..	..	..	244
100	146	11	6	11	0	0	..	..	..	..	..	174
117	389	32	11	6	0	0	..	..	..	..	..	438
121	242	11	11	..	..	..	..	..	..	..	..	264

**The smoke bomb was set off at –11 min., and the return air vents were closed at the start of the run. At time 0, the return air vents were opened; the number of air changes was estimated at 20/hr.*

***One man went into the room to pick up the impactor sample.*

Practical Ways To Keep Crane Cabs Cool

Fig. 1: *Interior of air-conditioned crane cab with heavy duty split-system evaporator mounted on wall. Cabinets next to unit contain dual thermostat control and air-conditioning and heating contactors. This cab is fully insulated.*

by **F. W. Wendelburg**
Chief Engineer,
Electrical, Industrial Div.,
Harnischfeger Corp.

In steel mills, aluminum plants, copper converters, foundries, incinerators, wherever cranes are used over hot operations, cooling in the crane cab is a "must." A large crane-maker gives details.

"KEEPING COOL" is highly important in many types of crane operations where a load worth several thousands dollars may be riding on the hook. More and more, plant managements are realizing that much of the continued efficiency of a crane operator depends on his physical working conditions.

If the operator is hot, tired, or uncomfortable, he obviously cannot exercise the skilled judgment required or make the split-second decisions called for in such work. Therefore, in many instances it is simply a matter of good business judgment to air-condition crane cabs. It has been our experience at the Harnischfeger Corporation that increasing numbers of overhead cranes are being shipped to customers with complete comfort conditioning.

As the world's largest builder of overhead cranes, Harnischfeger has a vast background of operating experience to draw upon in recommending the use of air conditioning equipment for crane cabs. However, the company regards itself as crane builders; not air-conditioning experts, and in all cases Harnischfeger finds it desirable to work closely with manufacturers of cooling equipment to assure recommending the most satisfactory type and size unit.

Many P&H Cranes serving such locations as steel mills, aluminum plants, copper converter aisles, steel foundries, forge shops, paper mills, cement plants, garbage incinerators, and some chemical operations now have cab air conditioning installed at the factory. In general, cranes are furnished to the customer with complete air conditioning where service involves high temperatures, dust, odors, objectionable fumes, or a combination of these factors. Since all of these objectionable factors have a tendency to rise, a man on the floor may be fairly comfortable, but conditions in the crane cab may be close to unbearable because of fumes, heated air, or dust collecting near the roof. In outdoor crane locations, the all-steel cab with its limited air circulation can practically "bake" the operator under a hot summer sun.

Air-conditioning for crane cabs may vary from

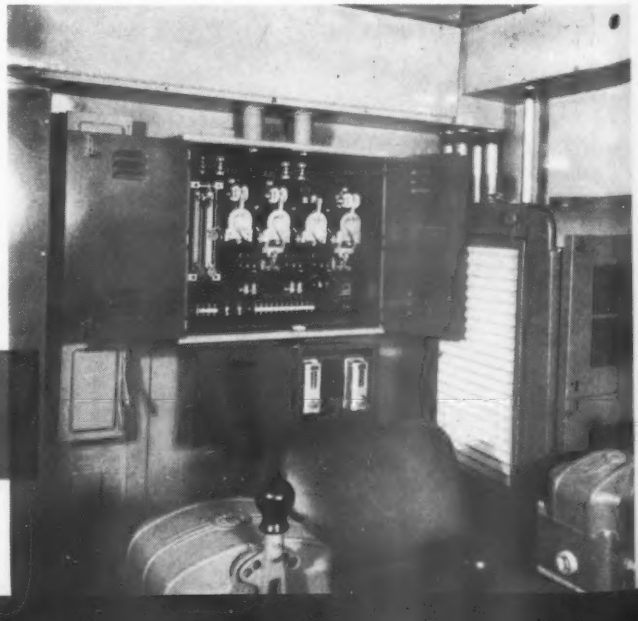


Fig. 2: *Cabinets opened to show heavy-duty contactors and control panel. Since units function in filtered atmosphere, ordinary enclosures can be used.*

simple, standard window units costing a few hundred dollars to complex industrial units representing an investment of several thousand dollars each. Units are usually selected to bring temperatures in the cab down to 80° to 85°F.

As a rule, units for P&H crane cabs are chosen on the basis of atmospheric conditions and ambient temperatures in the crane's operating area. Other factors to consider are the physical size of the cab and its construction – particularly whether or not it is insulated, and, if so, how much insulation is used.

Harnischfeger's cab construction for air-conditioned units depends principally on the ambient temperature. As a rule, where temperatures do not exceed 125°F, Harnischfeger omits insulation and supplies the conventional enclosed steel cab. However, as ambient temperatures increase above 125°F, insulation varies from one-half inch insulating board in walls and roof and single-glazed windows, to two inches of high efficiency insulation in walls and ceiling plus double-glazed windows.

Cab-floor insulation is very important, especially where the operator must be protected from heat radiated from the floor below. Insulation in P&H crane-cab floors may vary from three-fourths inch insulating board to eight inches of high efficiency insulating material.

It seems almost unnecessary to add that Harnischfeger builds air-conditioned crane cabs so that they are completely enclosed and reasonably sealed to prevent excessive heat gain.

Self-Contained vs. Split Systems

In addition to window air-conditioners, which are furnished only when the cooling load is very low, Harnischfeger supplies two other types of units for crane cabs. One is self-contained; the other, a split system. The self-contained unit comprising all necessary equipment is usually mounted on the bridge footwalk above the cab, or outside the cab on a platform. Insulated ducts from the unit introduce cooled, filtered air to the cab. Such an arrangement also requires a separate, insulated return air duct.

Because of the more complicated installation of self-contained units, split systems are becoming more and more widely used. Split systems are constructed with the condenser and evaporator as two separate, distinct units, The condenser unit is complete with compressor, condenser, coils and receiver, and is usually mounted on the footwalk. Because of its smaller physical size, the evaporator unit is easily mounted on the cab floor, ceiling, or wall. It contains the cooling evaporator, blower, and necessary filters for the ventilating air. Makeup air is usually furnished directly to the evaporator unit through a small screened opening in the side of the cab. Condenser and evaporator units are connected by means of two refrigerant lines.

(Please turn to following page)

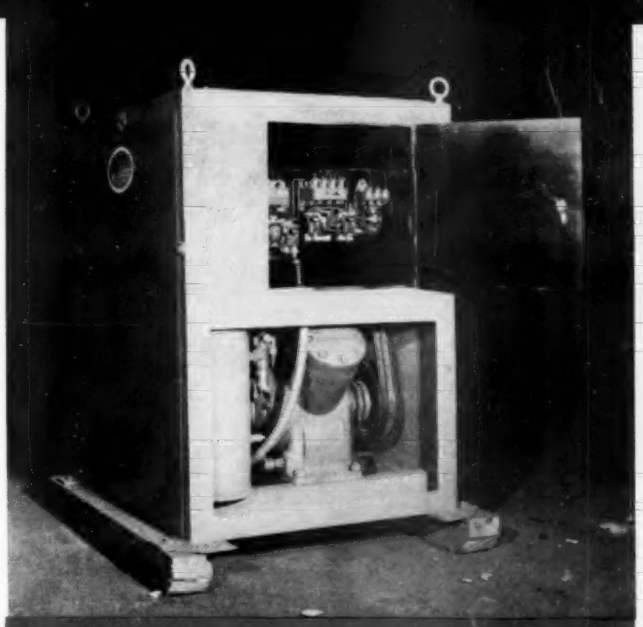


Fig. 3: Typical condenser unit for split system, shown with panel doors removed. Note the heavy-duty, industrial type compressor.

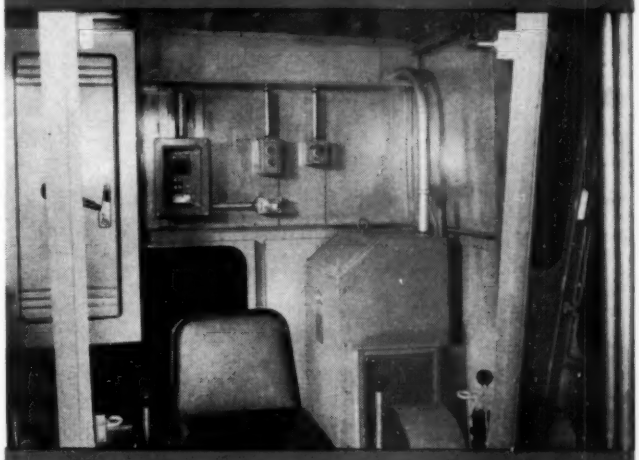


Fig. 4: Interior of non-insulated cab with air conditioner with heating. Note thermostat and control behind operator's chair.

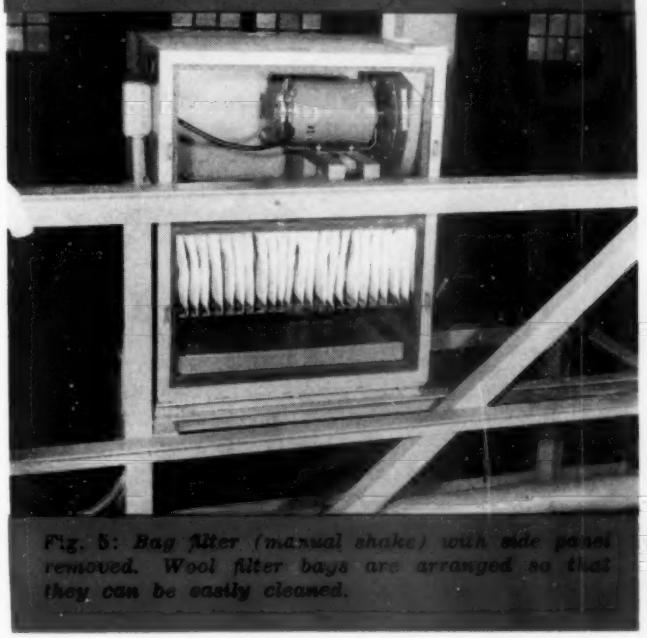


Fig. 5: Bag filter (manual shake) with side panel removed. Wool filter bags are arranged so that they can be easily cleaned.

Cooling Crane Cabs

(Continued from preceding page)

Harnischfeger also furnishes most air-conditioning units for crane cabs with built-in heating units to provide heated air in wintertime for outdoor or unheated plant operations. These units are usually sized to furnish cab temperatures of 70° when the ambient temperature is 0°F. The operator selects either heating or cooling; thermostatic controls in the cab maintain temperature at the desired level.

Dust, Fume Control Important

In many applications, control of dust, fumes, gas, or odors is just as important, or even more important, than temperature control. All air-conditioning units furnished with P&H cranes are designed to provide fresh, uncontaminated air to the operator. If an excessive amount of dust is present at the cab level, it is vital that the make-up air to the conditioner be thoroughly cleaned before it enters the unit to prevent clogging of the filters, too-frequent filter replacement, and possible breakdown of the cooling cycle.

Harnischfeger utilizes wool bag filters for removing excess dust from the air before it reaches the air-conditioning unit. This separate, self-contained device consists of a series of wool bags through which the make-up air is forced. To keep air flowing freely the wool bags are designed so that they can be either automatically or manually shaken to remove dust accumulation.

Control of gas, odors, or fumes, while it is done every day, is somewhat more complex. It is usually wise to consult manufacturers of this type of filtering equipment for recommendations on the best means of removing various concentrations of contaminants.

Activated Charcoal Filters

Harnischfeger has found that activated carbon filters do a highly effective job of adsorbing most odors, gases, and fumes. The number of these filters required depends on the particular application. If carbon monoxide is present in the air in any appreciable quantity, special procedures should be used for filtering it, since activated carbon does not adsorb this gas readily.

The operator's nose is probably the best judge of when the carbon filters need replacement, since he will begin to smell the contaminants (except CO). Saturated filters can be reactivated by the manufacturer, and this is usually done on an exchange basis – old filters for new.

Conditioned Air For Controls

Conditioned air is also becoming increasingly important in overhead crane operation for preventing entry of dust, corrosive fumes, and other foreign material as well as maintaining an optimum operating temperature for the more complex electrical and electronic control systems now being used.

For example, Harnischfeger recently shipped two 14-ton cement-plant cranes of a unique walk-in girder type, which may set a pattern for this and other industries where large amounts of dust, smoke or damaging fumes may be present. All electronic and electrical controls for these cranes are mounted *inside* one of the girders that form the cranes' bridge. This protects the controls from the large amount of highly abrasive cement dust that is constantly in the air, and eliminates the need for separate dust-tight control enclosures.

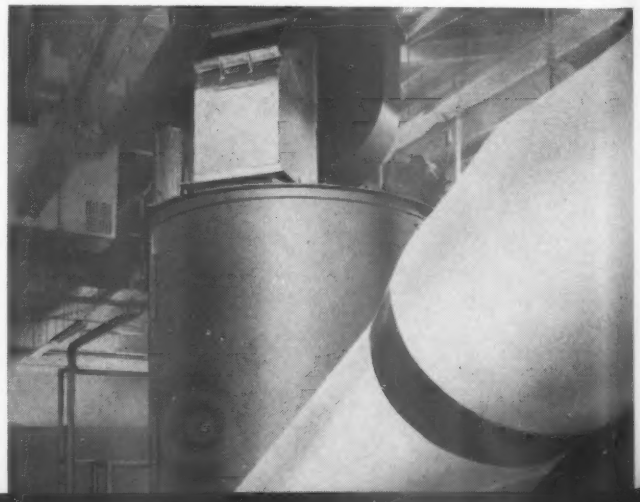
Dust-tight walk-in doors at either end of the girder permit easy access for inspection or maintenance. Just as important, the walk-in girder is equipped with a blower and filter arrangement that keeps its interior at two to three pounds above atmospheric pressure and, at the same time, assures that only clean air will enter the section – adding years of service life to the controls and minimizing breakdowns and operating delays.

No matter how severe operating conditions are, comfort conditioning can be provided for the operator and even for the electrical equipment – conditioning that will keep both working at maximum efficiency at all times. Therefore, it is important that the customer give the crane builder complete information on conditions that will be encountered in service, so that air-conditioning equipment of the proper type and size can be furnished. It is also important that air conditioning be specified in the original crane order, since modifying an existing crane is usually impractical. ▲▲

Fume Scrubber For Nitric Phosphoric Acid

In the cleaning and plating department of a large auto parts manufacturer, the fumes from an aluminum bright dip tank are handled by a canopy type hood built of Rigidon plastic. Fumes are carried to the scrubber by 36 in. plastic duct, as shown at right.

Fume scrubber has 16,250 cfm capacity, is of steel lined with sheet vinyl. It's filled with plastic packing, treats fumes with recirculating caustic neutralizing solution. Scrubber, duct and hood by Heil Process Equipment Corp.



Mobile Monitoring Station

(Continued from page 34)

surizes the water system air tank. The second subsystem is a vacuum system, with its sample being drawn through the four air pollution analyzers by means of two additional pumps.

The station has a sink and water storage tank, cabinets for housing lab instruments, as well as refrigeration, pumps and control panels for the air sampling system.

Has Own Water Supply

It also has its own power supply, a gasoline engine coupled to a 5,000-watt generator on a small trailer. The unit, which also can be plugged into a standard electrical current, has a 250-ft. power line which enables the truck to be parked far enough from its trailer's gasoline engine to escape its direct exhaust fumes. ▲▲

Right: *Inside Orange County's (Calif.) mobile air monitoring station, William Fitchen, APC officer, points out the workings of air pollution analyzers to (from left): Al Cuba, instrument technician; and William Petersen, senior instrument technician.*

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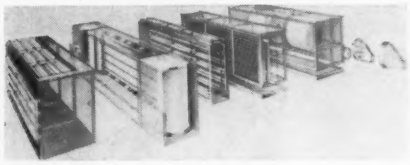
New PRODUCTS

Central Station Air Conditioner

Purpose: Provide central station air conditioning from one package engineered to meet exact conditions of air quantities, temperatures, humidities and air cleaning.

Features: Penta-post frame, five angle corner post, welded construction of heavy gauge steel, opposed blade dampers, and complete selection of "Better Air" filters. Filters available include AMERglas throw-away, HV2 permanent, Rollotron and automatic.



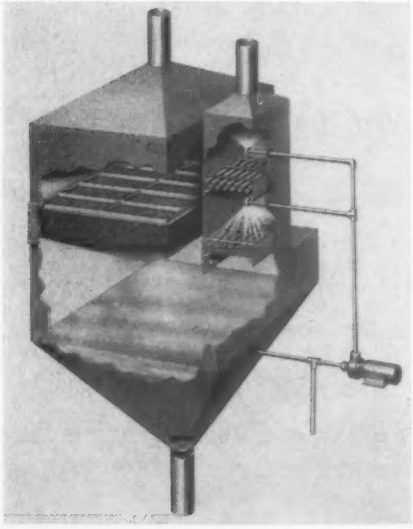
Horizontal and vertical models are available in 14 basic sizes with 24 variations for each—500 cfm to 36,000 cfm, up to 9 in. s.p. Complete accessory line offered. Bulletin AC-100 gives full details.

Source: American Air Filter Co., Inc., Dept. AE-1-PD, 215 Central Avenue, Louisville 8, Ky.

Coal Dust Air Scrubber

Purpose: For dust collecting problems of various types of processing plants.

Features: Utilization of a water spray over stainless steel screening to entrap impurities. Discharge air may be recirculated in the plant or released to atmosphere without risk of contamination.



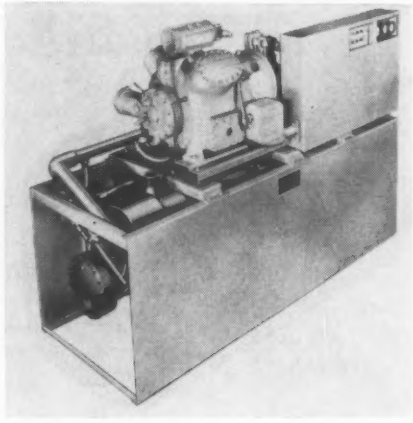
With no moving parts, the scrubber is said to be easily maintained. Pressure drop of air entering the system is low, thus reducing power requirements. Self-cleaning design permits constant operation. Dust recovery is claimed to be as high as 99 percent and the low water consumption of as little as 1 gpm/1,000 cfm of air. Capacities up to 50,000 cfm.

Source: Jack Gallagher, ANTI-POL, Dept. AE-1, 407 Hill Arcade Bldg., Galesburg, Ill.

Package Liquid Chillers

Purpose: For air conditioning or industrial cooling applications.

Features: Available in eleven models for net rated capacities up to 67.1 tons, depending upon condenser water temperature conditions and desired leaving chilled water temperature. Standard design units are also available without condenser and with accessories for use on remote condenser applications.



The package design is complete, requiring only a minimum of water piping and electrical connections to be made in the field. Hermetic compressor construction is said to eliminate problems associated with field alignment of compressor and electric motor drive.

Automatic safety switches provide for motor overload, high motor temperature, low oil pressure, high condenser pressure or low cooler pressure. The control panel, standard on all models, includes an indicator system that facilitates normal operating or trouble-shooting procedures.

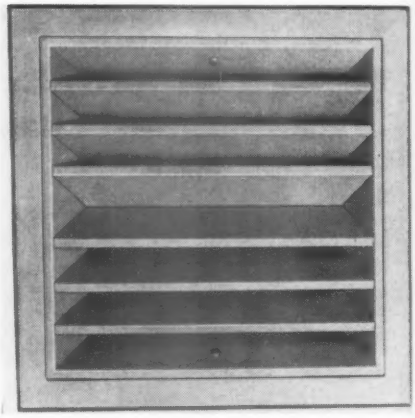
Pilot lights indicate normal unit operation. They immediately identify shut-down causes, thus pinpointing the trouble source when a safety device stops the machine. To protect operating and maintenance personnel, the control panel is divided into two separate compartments: one for the 115-v control circuit, and the other for the higher voltage power circuit.

Source: American-Standard Corp., Dept. AE-1, Industrial Div., Detroit 32.

Air Diffusers

Purpose: For use in commercial and comfort ventilation.

Features: Available in both square and rectangular designs. A variety of air pattern arrangements to satisfy different application and installation requirements. The 1, 2, 3, 4-way blow is available in square or rectangular configurations, and in a range of sizes.



Standard finish is baked enamel. Colored units to match any ceiling finish are available on special order.

Source: Connor Engineering Corp, Dept. AE-1, Danbury, Conn.

Automatic Dust Collectors

Purpose: A self-cleaning unit for automatic collection of dust.

Features: Constructed of polished aluminum, unit cleans in three ways: (1) periodic shaking of cloth filter tubes combined with reverse airflow through the filters; (2) continuous removal of collected material by an adjustable screw conveyor at the base; and (3) discharge of collected material through a rotary feed valve.

Modular sections permit adap-

tion to varied dust collection and space requirements. Eleven models, ranging from 2 to 12 in number of sections incorporated. Each model

is 5 ft. deep and 15 ft., 6 in. high. Widths from 4 ft., 8 in. to 21 ft., 10 in., depending upon number of sections employed in one bank.

When cleaning, the unit periodically shuts each section down to create a vacuum and a reverse airflow that blows dust from filters in that section. Up to 58,000 cfm of air can be handled through a single 12-section model.

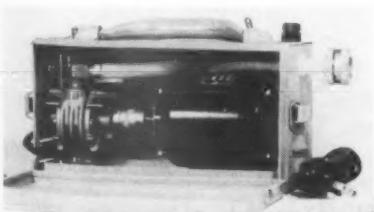
Source: Torit Mfg. Co., Automatic Collector Div., Dept. AE-1, 1131 Rankin St., St. Paul 16, Minn.

New Plastic Filter Media

Purpose: For permanent filter installation requiring large dirt-holding capacity.

Features: Breaks an air stream into little jets as it passes through the filter. Dust and dirt cannot follow and are trapped in great quantities by the cells. Designed as a permanent filter, Foamat will not pack, settle, separate or develop 'thin' spots.

Eliminates media replacement and offers greatly reduced maintenance. Can be washed with a standard spray-head hose nozzle without removing the filter from the filter bank. Where stubborn process dusts are encountered the filters may be removed, soaked in a mild detergent, rinsed with cold water, and reset in place.



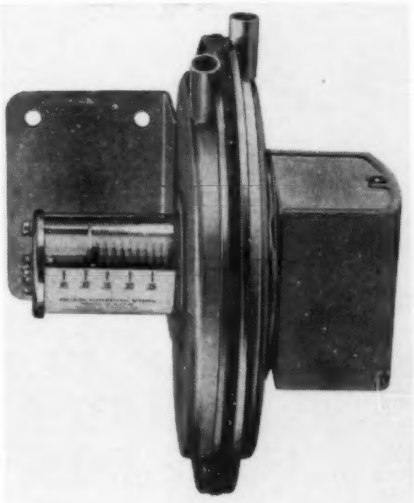
Filter media is pleated into a holding frame to present the greatest area for dirt storage. It is completely inter-changeable with other pleated-media filters. Foamat is resistant to all moisture and vermin and is chemically treated for permanent flame resistance.

Available in three models which permit capacities as high as 1800 cfm per cell, Foamat is designed to handle velocities to 450 feet per minute. Non-corrosive aluminum cells are standard.

Source: Product Bulletin No. 208, gives construction, operating characteristics, engineering and performance data, Dept. AE-1-PD, American Air Filter Co. ,Inc., 215 Central Ave., Louisville 8, Ky.

Pressure Switch

Purpose: To provide control in pressure ranges too low for conventional switches.



Features: Switch is claimed suitable for such applications as induced draft interlocks, exhaust hoods, dust collection systems and air filters. Specific examples include air velocity detection, control of air curtain systems, counting devices, monitoring of pressurized rooms or areas.

Unit's pressure set point is easily visible on an accurate scale marked in inches of water. Calibration adjustments may be sealed or safety wired, making the switch tamper proof.

Source: F. W. Dwyer Mfg. Co., Dept. AN-8 (AE-1), P.O. Box 373, Michigan City, Ind. Bulletin No. E-30.

Flow Monitor

Purpose: For mass flow measurements of predetermined air or gas flow rates.

Features: Center reading flowmeter, variable sensitivity and range. Adjustable for a wide range of flows at midscale by means of interchangeable flow tubes and control adjustments. For example, with the flow tube of $\frac{3}{8}$ in. diameter, the range at midscale can be varied to read as little as 90 std cc/min. or as high as 40,000 std cc/min. (.003 to 1.4 cfm).

Larger flow tubes up to 1 in. diameter extend the range to appropriate higher values.

Unit has an increasing sensitivity to low flow rates as zero flow is approached, unlike flowmeters which require some flow before beginning to operate. Elimination of pressure drop through the flow tube and its ability to withstand overflows and overpressures of ten times normal range without damage, is claimed by manufacturer as unique feature. Operation is from 90-135 volts AC, 60 cycles.

Source: Hastings-Raydist, Inc., Dept. 10, AE-1, Hampton, Va.

Portable Spiratube Duct

Purpose: For ventilation, materials handling, and fume and dust removal systems.

Features: Lightweight, rugged and portable.

"Facts about Spiratube" brochure available, listing specifications.

Source: Flexible Tubing Corporation, Dept. AE-1, Guilford 2, Conn.

(Please turn to following page)

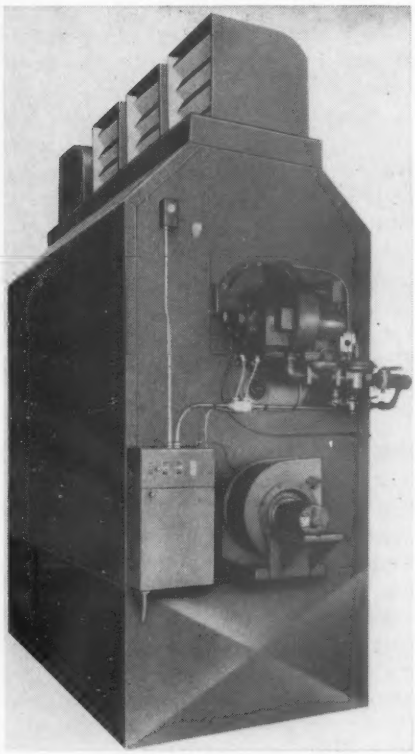
New PRODUCTS

(Continued from preceding page)

Direct-Fired Heaters

Purpose: For firing with light oil, gas, heavy oil and combinations of the above fuels.

Features: Sizes from 2,000,000 to 4,000,000 Btu. Adaptable for heating large open areas such as warehouses, foundries, factories; in addition to duct systems for schools, churches, and public buildings. Extremely high efficiency, according to manufacturer, is obtained in these direct-fired units through use of a newly designed burner.



The burner, developed some years ago and field tested extensively, is equipped with high-low fire electronic flame scanning equipment, automatic electronic controls and a forced draft air/fuel atomization process.

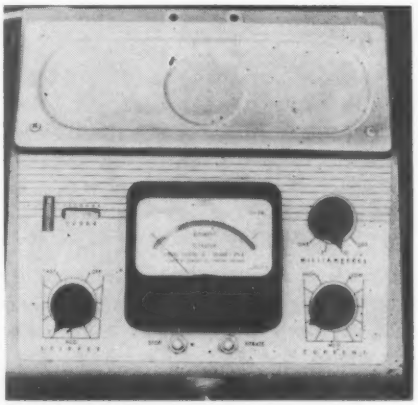
Source: Jackson & Church Div., Dept. AE-1, York-Shipley, Inc., P.O. Box 349, York, Pa.

Automatic Titrator

Purpose: For quick measurement of bromine number without standardization of solutions or samples.

Features: The olefin content of gasoline reported as its bromine number has become an important factor to petroleum marketers and refiners now that a direct correlation to smog and eye irritation has been found.

That unit is said to quickly measure the bromine number with excellent accuracy.



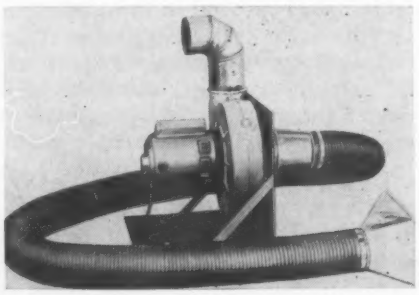
Source: Central Scientific Co., Dept. AE-1, 1700 Irving Park Rd., Chicago.

Portable Fume Exhaust

Purpose: To exhaust fumes from welding, soldering and brazing operations.

Features: Unit is complete: blower, motor, switch and power cord on a universal mounting base and is equipped with two 60 in. sections of 4 in. diameter flexible hose and a pick-up nozzle with an 8 in. x 4 in. rectangular opening.

With a ½ hp ball bearing 115/230 v totally-enclosed, lubricated motor, the unit is said to exhaust 600 cu. ft./min. The hose may also be connected to the adjustable elbow discharge of the blower, converting the unit into a blower. Blower housing and wheel are non-sparking cast aluminum; an explosion-proof motor can be supplied for handling hazardous fumes.



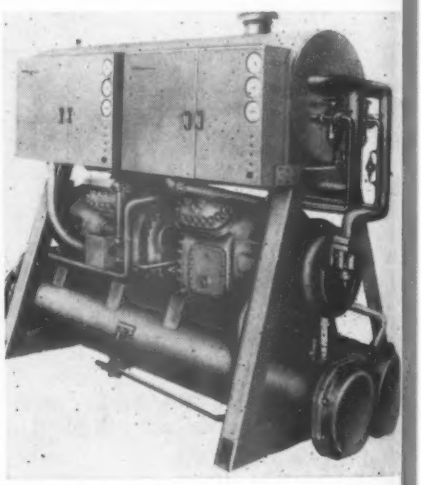
Other uses suggested for the unit include: cooling of overload electrical equipment; ventilating man-holes, sewers and tanks; removal of automobile exhaust fumes; cooling electrical and electronic enclosures and many other exhaust, spot cooling and general purpose blowing applications.

Source: Cincinnati Fan & Ventilator Co., Dept. AE-1, 3542 Montgomery Rd., Cincinnati 7.

Water Chiller

Purpose: Packaged water chillers for use in industrial and commercial air conditioning installations.

Features: Eight sizes of units in ratings from 20 to 100 tons. The compressor motors are protected by an overtemperature control circuit that provides positive motor protection against overheating from any cause: excessively high or low voltage, single phasing, or loss of Freon from the compressor.



In addition, quick trip overload heaters are included for positive six-second kick out on any overload condition, even on cold start.

Larger units, rated at 60, 80, and 100 tons, have twin compressors that provide step starting, demand charge savings during mild seasons and protection against complete loss of service in event of failure in one system.

Each unit is compact and complete with a wired control center that includes starters and safety operating controls. For process cooling and special commercial installations, 40 degrees leaving tem-

perature designs are now available.

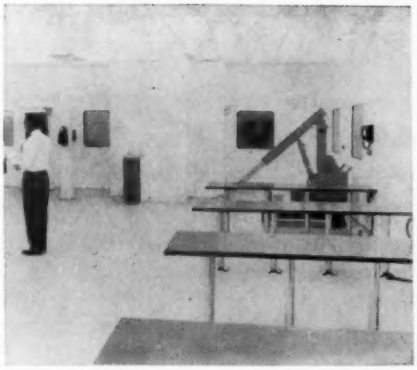
Source: Westinghouse Electric Corp., Dept. AE-1, Air Conditioning Division, Staunton, Va.

Pre-Fab Clean-Room Structure

Purpose: To provide ultra-clean environments during testing, assembly, and repair of high-precision missile and space vehicle components.

Features: Typical is the structure installed recently in the assembly area of Hughes Aircraft Co., electronics manufacturing plant, El Segundo, Calif., for assembly, test, and rework of Polaris missile equipment. The prefabricated chamber is constructed of modular, insulated panels, incorporating necessary doors, windows, lights, ducts, and utilities in a sealed outer structure.

The most minute dust particles are said to be excluded from the chamber by a packaged air-conditioning system with special filters which also provides precision temperature and humidity control. A high-intensity lighting system supplies evenly diffused illumination suited to close tolerance work.



Modular design of the insulated panels permits easy assembly, disassembly, expansion, or modification of the clean rooms. Movable interior partitions afford further flexibility.

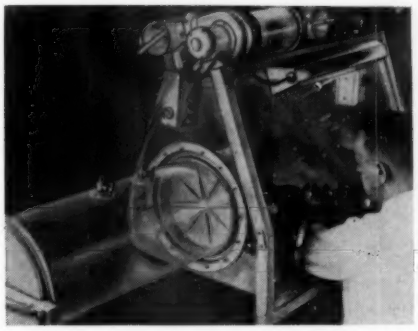
Source: General Acoustics Corp., Dept. AE-1, 12248 Santa Monica Blvd., Los Angeles 25, Calif.

Dry Box Gloves

Purpose: For work with extreme low humidity dew points or rare and inert gases with an absolute minimum contamination.

Features: Said to be ten times less permeable to gases and moisture as existing neoprene gloves, and to have outstanding resistance to concentrated acids, solvents, ketones, etc. Made of one piece, seamless construction.

Source: CAEMCO, Dept. AE-1, P.O. Box 3693, Jacksonville 6, Fla.

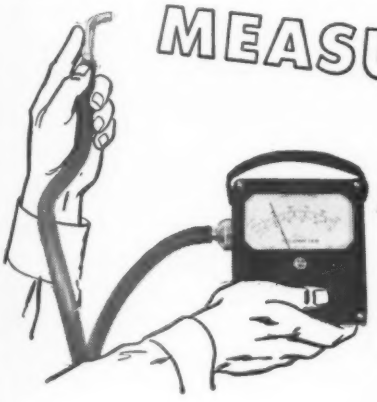


Solid Plastic Roof Ventilators

Purpose: For the removal of corrosive fumes.

Features: Upblast discharge blows fumes high into air, minimizing corrosion to nearby roofs and ground areas, and reducing chances

(Please turn to following page)



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The Velometer is the only instantaneous, direct reading air velocity meter—accurate in all ranges, from high to low... compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

Take the recommendation of every major manufacturer of air diffusers and leading contractors—get an Alnor Velometer. Send for Bulletin 2448-G. Write:

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- Cast Iron Base; 20-inch spread. 1⅛" steel glides.

Other White Room chairs with lacquered plywood seat and backrest.

FREE TRIAL Use an AJUSTRITE chair for 30 days without obligation. Prove to yourself the many advantages AJUSTRITE offers in comfort, utility and economy. Write today—we'll do the rest.

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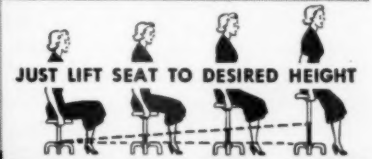

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Bowling Green, Ohio

(Continued from preceding page)

of fumes re-entering plant. All exposed parts including housing and impeller built of plastic. Ten standard sizes, 400 cfm to 15,000 cfm.

Source: Heil Process Equipment Corp., 12850 Elmwood Ave., Dept. AE-1, Cleveland 11. Engineering Data Sheet E-7801.

Infra-red Heaters

Purpose: For a wide variety of heat transfer requirements, including baking, drying, curing, bonding, preheating, softening, and evaporating.

Features: LP gas energy is directly converted to infra-red heat energy on a catalytically active metal screen. The screen itself is the radiant heat source. Manufacturer reports ". . . . complete and accurate infra-red source temperature is available. Surface

temperature of the catalyst screen can be held automatically at any point between 800° and 1500°F by proportionate control of the gas flow."

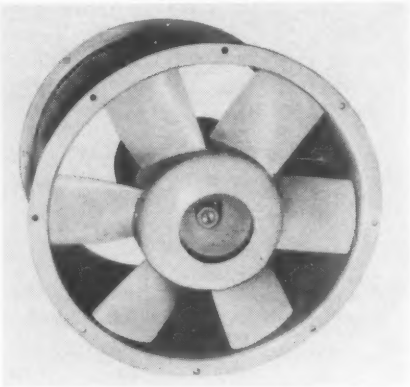
The low temperature permits work to be placed close to the infra-red heat source, to obtain optimum heat transfer efficiency. Heating panels are available in standard sizes, and are readily adaptable for mounting and grouping.

Panels are designed to provide heat release rates between 2,000 and 12,000 Btu/hr/sq. ft. of emission surface. This is approximately equivalent to a range of 4 to 24 watts/sq. in.

Source: Catalytic Combustion Corp., Dept. AE-1, 4725 Fourteenth St., Detroit 8.

Axial-Flow Vent Fans

Purpose: For general ventilation, dust and fume removal and similar services.



Features: Designs are based upon heavy-duty units which for many years have been furnished for Navy and Merchant Marine use. Fans are available in direct-driven and belt-driven vane-axial types, and direct-driven tubeaxial types for use where air-straightening vanes are not required.

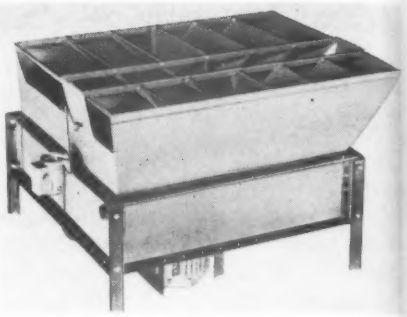
Capacities at zero static pressure range from 3220 to 72,500 cfm. Features include airfoil fan wheels, flanged heavy-gauge fan casings, sealed-prelubricated, self-aligning bearings, and improved capacity per hp.

Complete choice of motor types is available, and options include aluminum fan wheels, anti-corrosion materials and protective coatings, inlet and outlet cones, and adjustable sheaves for the belt-driven units.

Source: L. J. Wing Mfg. Co., Dept. AE-1, 2300 N. Stiles St., Linden, N. J.

Discharge Door Heaters

Purpose: To stop cold drafts through plant shipping doors when they are open, and supplement plant heating system when doors are closed.



Features: Door heater automatically provides a high-velocity curtain of warm air when a door opens, to penetrate and temper inrushing cold outside air. When the door closes, a damper is automatically repositioned for discharge of warm air at normal velocity, to provide either room or perimeter heating under room thermostat control.

In summer, the fan may be operated without heat to promote air circulation. Ten sizes for mounting heights to 22 ft. and floor area coverage up to 60 x 132 ft. when mounted for room heating, or 33 x 180 ft. when mounted for perimeter heating. Steam or hot water may be used.

Unit available for replacement of standard discharge sections on existing Wing door heater installations.

Source: L. J. Wing Mfg. Co., Dept. AE-1, 2300 N. Stiles St., Linden, N. J.

Aluminum Air-Foil Damper

Purpose: Extruded aluminum damper with an air-foil double blade.

Features: Said to be completely air-tight, because of the use of polyvinyl stripping where blade meets the frame. Blade sizes are of any length, 5 in. to 9 in. wide. There is positive blade turning because of the special pin lock-groove design. Nylon bearings are used throughout.

Dampers are available either with parallel or opposed action. When closed, the double blade, with its air space in between, acts as an insulator.

Source: Arrow Louver & Damper Corp., Dept. AE-1, 72 Berry St., Brooklyn 11.

New PRODUCT OF THE MONTH . . . .

From Philco's new line of decontamination control equipment for use in a super-clean environment. Shown above, vacuum ovens and dry boxes.

PHILCO'S LANSDALE Division sees its recently formed equipment development and manufacturing operation as a group of highly skilled engineers and production specialists ready to tackle any customer specification for a controlled environment production system.

A complete system including dry boxes, dust shields, vacuum ovens and accessories, for precise control of purified atmosphere for manufacturing, assembly, and testing precision components and parts, has recently been introduced.

This machinery was designed for encapsulation of precision-etch transistors, which called for one of the tightest specifications for sustained environment control possible.

Philco's contamination control equipment is claimed to provide five microns of oven vacuum and to maintain less than 10 ppm water vapor when in operation.

Transistors, diodes, rectifiers and new solid state electronic devices are a good example of minified components which must be fabricated and sealed moisture and dust free under controlled atmospheric conditions.

In addition to electronic devices, some miniature mechanical parts such as ball bearings must be kept in a dust and moisture free environment when incorporated into components.

Atomic energy research and processing finds a need for air purification in handling radio isotopes.

Variations of the system's basic building blocks comprising vacuum ovens, dry boxes, dust shields and accessories, can readily provide controlled atmosphere machinery for many areas of industrial manufacture, assembly, and testing of precision components.

Applications of Philco's new line of contamination control products include such areas as component manufacture (transistors, diodes, rectifiers, etc.) and environment controlled processing of metals, chemicals, contaminants, pharmaceuticals, foods, and biological specimens.

Production of foods, drugs, biological and chemical processing are other areas where the need for such equipment is growing as contaminant-free manufacture is more extensively used.

Philco's equipment operation has a full complement of engineering, production and sales functions to meet custom specifications. A special "new systems committee" has been set up for "brainstorming" new variations of processing equipment.

The operation's present stock of modular dry boxes, dust shields, vacuum ovens and accessories serve as building blocks for custom built systems.

For further information, write: Philco Corp., Dep't. EO-624-AE-1, Lansdale Division, Lansdale, Pa. ▲▲

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500 cfm to 40,000 cfm Capacities

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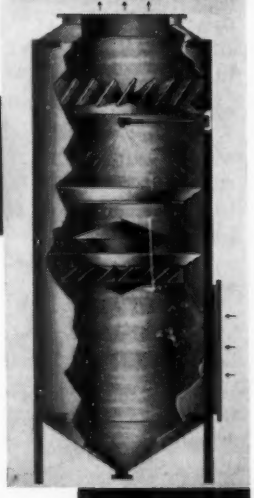

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CARPART CORPORATION Mfg. Div. OWOSSO, MICHIGAN

New Literature

Blast Coil Heaters

● Greatly expanded list of stock heaters available is given with application information, construction data, advantages of blast coil heaters, wiring diagrams, special constructions and accessory equipment. *Industrial Engineering & Equipment Co., Dept. AE-1, 24 Hanley Industrial Court, St. Louis (Brentwood) 17, Mo.*

Heating Schools Electrically

● Bulletin devoted to installation illustrations, specification and product application data, and features that are of interest to school boards, architects and builders alike. Copy explores advantages of electric heating, with case history given. *Edwin L. Wiegand Co., Dept. AE-1, 7500 Thomas Blvd., Pittsburgh 8, Pa. Bulletin F00101-1.*

Mechanical Draft Fans

● Pertinent design features of fans for induced draft service; charts mechanical efficiency, provides table listing sizes from 20 in. diameter to 80¾ in. diameter fans. Lists optional and auxiliary equipment available. *Chicago Blower Corp., Dept. AE-1, 9867 Pacific Ave., Franklin Park, Ill. Bulletin RT-100.*

Rotary Evaporative Coolers

● Four-page illustrated bulletin on redesigned evaporative cooler for commercial and industrial applications is available. Features of the product include: bronze disc screen rotor, sealed electric gear motor, automatic external flush valve. *Farr Co., Dept. AE-1, P.O. Box 90187, Airport Station, Los Angeles 45, Calif.*

Processing Equipment Catalog

● Condensed catalog of materials handling and processing equipment is designed to provide comprehensive view of pneumatic systems and unit machines available. Shown and described are: pumps, blowers, feeders and cyclones; horizontal mixers; knife cutters; saw tooth crushers; gyro sifters; attrition mills; hammer mills, and pulverizers. *The Young Machinery Co., Inc., Dept. AE-1, Muncy, Penn. Bulletin 102.*

All-Products Bulletin

● Four-page bulletin describes and illustrates representative models of linear, square, rectangular, and circular ceiling air diffusers, grilles, registers, high velocity equipment, air recovery and purification cells and canisters. *Connor Engineering, Dept. AE-1, Danbury, Conn.*

Dust Control Bulletin

● Discussion of four main types of dust control products: dry centrifugals, wet collectors, fabric collectors and electrostatic precipitators. Explains and illustrates thirteen different products, capacities and applications. *American Air Filter Co., Inc., Dept. PD, AE-1, 215 Central Ave., Louisville 8, Ky. Bulletin #271.*

Sampling of Dusts In Ducts

● Sampling for dusts in process ducts, stacks and vents presents problems for industry. Manual #15 discusses these problems and presents methods to obtain accurate samples. *Gelman Instrument Co., Dept. AE-1, 106 N. Main St., Chelsea, Mich.*

Receiver Gauge Catalog

● Description of complete line of dial indicating receiver gauges offered. Lists specifications for bourdon tube and diaphragm-actuated types. Information on materials, dials, ranges, case styles and sizes. Tables on selection facts; various models illustrated. *United States Gauge, Div. of American Machine & Metals, Inc., Dept. AE-1, Sellersville, Penn. Catalog #520.*

Seasonvent Unit Catalog

● Detailed information regarding sizes, capacities, accessories and applications. Selection data charts for any particular application, together with dimensional and arrangement data included. *McQuay, Inc., Dept. AE-1, 1600 Broadway St., N.E., Minneapolis 13, Minn. Catalog 575.*

Electronic Handbook

Covers application of electric and electronic controls in commercial and industrial air conditioning installations. Explains in detail the theory of electric and electronic control, makes comparisons between electronic and pneumatic controls, and is completely illustrated with photographs and diagrams. *Barber-Colman Co., Dept. AE-1, 1300 Rock St., Rockford, Ill.*

National Fire Codes

● Volume II deals with combustible solids, dusts, chemicals and explosives. Lists data pertinent to air conditioning and refrigeration field. Liberally illustrated, factual coverage highlighted with charts, graphs and pictures. Over 500 pages. Price $7. *National Fire Protection Assn., Dept. AE-1, 60 Batterymarch St., Boston 10.*

Plastic Ruler Atmosphere Table

● Six-inch plastic ruler for engineers showing new 1959 ARDC model atmosphere table with pressures and temperatures encountered at various altitudes up to two million ft. Shows temperatures in F, and air pressure in mms and inches of hg and also psia for altitudes from sea level to two million mark. *Tenney Engineering, Inc., Dept. AE-1, 1090 Springfield Rd., Union, N. J.*

Electromagnetic Booklet

● Twelve pages on conveyors, fans and pumps, winders, metal slitting and forming machines, paper mill machinery, etc. Illustrated description how electromagnetic drives work, what they include, and where used. Air cooled drives, integral and fractional, liquid cooled units discussed. *Westinghouse Electric Corp., Dept. AE-1, P.O. Box 2099, Pittsburgh 30, Penn. Booklet B-7875.*

Twin Duct Blender Catalog

● Product catalog for high velocity, double duct air conditioning systems. How new ceiling and under-window air blenders operate without the use of motors, piston operators, or mechanical linkage is explained, with design features. *Worthington Corp., Air Conditioning Div., Dept. AE-1, Technical Publications Section, Ampere Station, East Orange, N. J. Catalog 1100-B107.*

Questions & ANSWERS

(Continued from page 19)

920μ ranges. In Table II there are three type categories of five which do not "correlate" within the standard deviations; the shiny metallic-like, miscellaneous and fibers categories.

Some rationalizations for the discrepancies noted above are as follows: (1) At the time the dust samples were taken, factory personnel were not wearing special, fiber free clothing. There was no attempt to control the ensuing fiber fall-out. This would account for the larger fiber fall-out inside than outside the factory as well as the larger number of particles greater than 230μ found inside than outside the factory. The last because the particles greater than 230μ were found to be almost exclusively fibers. (2) A large amount of metal processing occurs inside the factory. This would account for the larger number of shiny metallic-like particles found inside than outside the factory. (3) When the difference between the fiber fraction inside and outside and the shiny metallic-like fraction inside and outside are added to the miscellaneous fraction inside we have the result; Miscellaneous inside (corrected) = 35.7 percent and Miscellaneous outside = 43.5 percent with the standard deviations of both, σ = 4.8 percent. The imagination can thus be stretched to imply a "correlation" in this category within the standard deviations.

The standard deviations (σ) indicated in Tables I and II were calculated from the results of the dust samples taken inside only. It is assumed that the standard deviations outside would be fairly close to those measured inside.

It can be argued that the "correlations" given above are by themselves weak. That is, one wouldn't want to make any very expensive decisions based upon these "correlations" alone. However, with the results of the spectrographic analyses in mind along with these other "correlations" I feel that "there is fairly strong evidence to indicate that a large portion of the airborne dust inside the factory comes from the immediate area outside the factory building."

Mr. Salzenstein points out that the next to last paragraph lacks a satisfactory closure. He is quite right. At the time "Fingerprinting" was written the factory had not taken corrective action on the copper contamination problem. Since that time, the cleaning and testing of these components has been moved to a dust controlled area. The contamination level has dropped well within a tolerable level, and this particular contamination problem has been eliminated.

I would like to indicate that the "Fingerprints" outlined in this paper are by no means the only "Fingerprints" that can be used. A more informative and conclusive approach would be to (1) identify the chemical constitution of each particle quantitatively as well as qualitatively, and (2) indicate how many particles there were of each

(Please turn to following page)

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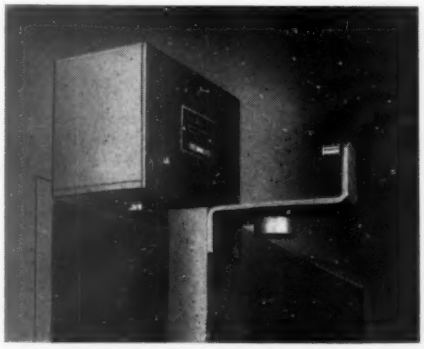

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- ✓ Requires no color matching — is independent of operator's color perceptiveness.
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Q & A, Dust Counts

(Continued from preceding page)

chemical type and size. This may at first thought seem impossible, since many of the particles of interest are submicrogram in weight and are not visible except under the microscope.

However, at the present time we are routinely performed qualitative analyses on individual metallic particles using the emission spectrograph. We have successfully determined the particular alloy of metallic particles as small as 20μ (greatest dimension). We hope soon to publish a paper indicating the techniques being used for these analyses.

D. P. Hoffman
Convair (Astronautics) Div.
General Dynamics Corp.
San Diego, Calif.

House Beautiful Carries Article On Air Pollution

The January issue of House Beautiful carries an article on p. 54, entitled "How To Protect Yourself From Air Pollution" by AIR ENGINEERING editor, Eugene A. Sloane. The article, written from a layman's standpoint, stresses the need for safeguarding yourself and your community from air pollution.

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RATES—Classified advertising is run in 6-point type (this size) under suitable headings. Minimum rate $5.00 for forty words or less. Extra words .15 each. Box addresses, with usual services, count as five words. Payment required with order. No agency commission, no checking copies. Closing date first of month preceding month of issue. No proofs will be submitted prior to running, but proof will be forwarded for record. No display advertising under classified headings. AIR ENGINEERING, 450 W. Fort Street, Detroit 26, Mich.

POSITIONS WANTED

38 YEAR OLD, married, graduate mechanical engineer seeking city or state air pollution control position. Has been instrumental in organization and administration of air pollution control departments throughout two states. Ten years' experience in major power plant, process and steel industry equipment. Five years as engineering officer in the armed forces. BOX AE-1611, Air Engineering.

POSITIONS AVAILABLE

GENERAL SALES MANAGER—An exceptional and executive earnings opportunity with a leading national manufacturer now greatly expanding plant and sales force. The man we want must know all types of replacement filter bags for dust collection and vacuum filters and must have a thorough knowledge of the market and the applications of the filter media in D/C and vacuum filters. Our man should be able to build and supervise a national sales force, traveling ½ of the time from Eastern plant. Remuneration is in keeping with experience and ability to produce. Write in complete confidence and we will arrange a meeting. BOX AE-1612, Air Engineering.

BUSINESS OPPORTUNITIES

EUROPEAN COMMON MARKET. The biggest single outlet for your product know-how outside the U.S.A. is Western Europe where fast-rising living standards mean improved heating and air conditioning. Are you organized in Europe to line up manufacturing licensees and supervise their activities? You can afford the on-the-spot supervision needed to get things rolling and follow-up. I have been successfully acting since 1954 as European liaison representative and District Manager for a select group of top U.S. companies in Heating, Ventilating and Air Conditioning. Can take on one additional account now. Write without obligation and meet me in Chicago at the February ASHRAE Show. J. J. LA RUS, European Sales & Licensee Supervisor, 2, avenue La Notre, Marly-le-Roi (S & O) France.